The connection between work organisation and wage payment: case studies on the interelation between working conditions and payment by results in plants belonging to a company locates in the Federal Republic of Germany ; final report

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EUROPEAN FOUNDATION FOR THE IMPROVEMENT OF LIVING AND WORKING CONDITIONS

THE CONNECTION BETWEEN WORK ORGANIZATION AND WAGE PAYMENT

Case studies on the interrelation between working conditions and payment by results in plants belonging to a company located in the Federal Republic of Germany

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Preface

This study deals with a few selected relations between production techniques, work organization and wage payment in a major electrical engineering company that has its registered office in the Federal Republic of Germany. Three plants belonging to this company were included in the surveys, which were carried out in 1980. Altogether 22 interviews were conducted with experts belonging to the company, namely representatives of the company management (group executives, plant managers, personnel managers, production managers, and staff of the work planning department and the time study department), supervisors and members of the works councils.

The authors themselves, it must be emphasized, recognize that the results of this study can serve only as an example; in view of the meagre financial resources and the limited time allowed, the surveys can rank only as a pilot study.

We thank the management of the company for its support in the completion of the surveys, and all the experts interviewed for their frankness and willingness to talk.

I. Introduction

A. Initial hypothesis and statement of questions to be examined

In this inquiry into the "Connection between work organization and wage payment" we start from the hypothesis that there are no axiomatic - determined by technical or economic factors - relations between production techniques, work organization and wage payment, but that it is precisely the openness and malleability of these interactions that gives them a strategic value of their own in the attainment of a company's interests. In accordance with this initial hypothesis we are of the opinion that general historical trends are not directly mirrored in the individual industrial establishment but lead to different problem situations and also to different approaches to finding solutions, depending on the specific set of conditions peculiar to each establishment[1].

On the other hand, our initial hypothesis does not mean that the choice of a certain production technique or a certain form of work organization, utilization of labour and wage payment can be made freely just as the

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1) For the principles underlying our thinking on company strategy, more detailed discussion of which is beyond the scope of this report, we refer readers to Altmann, N and Bechtle, G, Munich 1971 and Altmann, N, Bechtle, G and Lutz, B, Munich 1978, and also to Bechtle, G, Munich 1980 and Düll, K, Paris 1978.

company or its management deems fit. Many overriding economic and social conditions are beyond the immediate control of entrepreneurial action (such as cyclic trends, and legal and collectively agreed provisions governing the employment, development and labour market situation); and the existing internal structures (such as the state of production technology, organizational structure, structure of the work-force and industrial relations situation) likewise play their part, as localized conditions, in influencing the measures adopted by a company in these areas.

In this context, there are close reciprocal relations between the possible lines of action on production technology, work organization and wage payment. For instance, the ways in which production processes are structured, technically and in terms of work organization, also govern decisions on the applicability and practicability of certain principles of wage payment, particularly payment by results. Conversely, however, principles and methods of wage payment themselves are instrumental in determining the use of manpower in the production process (utilization of labour) and the performance of workers. Or, to put it in simplified terms: a company's wage policy always depends on the labour utilization policy that is pursued, as connected with the technical and organizational form of the production processes; to that extent, a company's wage policy is also invariably an expression of its policy as regards performance. Conversely, a company's performance is likewise always a consequence, in its premises and results, of its wage payment policy.

On the basis of these initial considerations, our main aim in the following case analyses is to throw light

on the following two questions:

- What problems arise in shaping relations between production techniques, work organization and wage payment to suit the general conditions governing the establishment's operation (market situation, etc) and its structural characteristics (technical and organizational form of production processes, employment structures, etc) and
- what interest is there for an establishment in specific combinations of production techniques, work organization and wage payment or in changes in these?

It goes without saying that our case analyses, which are confined to selected divisions of one large company in the Federal Republic of Germany, can serve only as examples with respect to these aims.

In order to bring out clearly the comparative importance of the interrelations and problems dealt with in the case analyses, in the remaining sections of this chapter we outline some recent developments in payment by results (Section B) and in production techniques and work organization (Section C) in the Federal Republic of Germany, together with a few basic aspects of industrial relations that are relevant to the questions we are examining (Section D).

In Chapter II we give a brief review of the field covered by the inquiry (industry, company, individual plants).

Chapter III contains the actual case analyses. The presentation is based on an empirically developed typology of the various forms of combination of production techniques, work organization and wage payment.

In Chapter IV we attempt, on the basis of our case analyses, to identify a number of more general effects and problems that arise for the plant itself, the workers concerned and industrial relations within the plant from the connection between wage policy and performance policy under different preconditions as regards production techniques and work organization.

B. Recent developments in wage payment systems in the Federal Republic of Germany

(1) Existing studies on developments in payment by results (PBR) in the Federal Republic of Germany largely concur in finding that traditional (or classical) piecework is becoming less and less commonly applied. However, findings and assessments concerning "new wage payment schemes" vary and are less precise. Whereas one of the pioneer works on the practice and development of PBR at the end of the 1950s still put forward the thesis of a fundamental crisis in PBR (Lutz 1975), more recent investigations come to a conclusion more or less opposed to this: namely, that there is a tendency towards the continued use and spread of PBR, although classical piecework is being replaced by new forms of incentive payment. A characteristic feature observed here is the change-over to forms of PBR which are "less sensitive to fluctuation" (Schmiede and Schudlich 1976), a development which can also be described as a trend towards "fixed wages". Examples of this are the so-called "frozen piece rate" (see below), the introduction

of premium wages and also, in this case, flat rates combined with systems of performance assessment (bonus schemes).

More precise and differentiated observations of developments in individual industries and different establishments make it appear doubtful whether there is at present any clear trend towards one specific new form of wage payment. On the contrary, the characteristic feature appears to be the existence and appearance of a number of different new variants of PBR, as a consequence of which the originally simple and sharp contrast between flat rate and piecework is becoming increasingly blurred (cf Weil 1878, p 43). There is therefore a need for more detailed investigations into the actual modification and application of PBR in business practice. Likewise, only in this way will it be possible to estimate whether and in what respects the changes currently observable in companies represent tendencies which will hold their own and indeed strengthen in the longer term, or whether at this stage they are not more an expression of a "search" for and experimentation with new forms of wage payment. It is found, for instance, that the wage payment schemes actually employed in companies cannot be allocated directly and uniformly to the categories of "piecework", "premium wage", "contract wage", etc. An example of this is the so-called "frozen" piecework rate: here, both performance and earnings are to a large extent actually fixed. Yet it is not - at least according to the usual definition - a "contract wage, since the wage explicitly contains certain performance-related components which can be influenced by the workers. (This means that at present great caution must be exercised in arriving at any conclusions at all concerning actual

developments in wage payment practices on the basis of statistics, which are sometimes based on simple distinctions between piecework and flat rates.)

Lastly, there is also a need to clarify more precisely whether and in what respects the tendency towards "fixed wages" (or forms of PBR less sensitive to fluctuation) that has been observable since as far back as the mid-1960s represents a more or less irreversible trend, or whether there are not situations in which companies revert to traditional forms of PBR instead of devising alternative wage payment schemes.

The aim of this inquiry is to look more closely, in the light of selected cases in plants in the electrical engineering industry, into the assessments and questions regarding developments in PBR which have just been outlined. The case studies show that establishments are making use of new forms of PBR in varying ways and that the "formal definitions" of the wage payment schemes used often do not adequately cover and reflect actual wage payment practices.

It can furthermore be shown that under certain conditions there is clearly also a reversion (or the possibility of a reversion) from "fixed wages" to traditional forms of piecework.

(2) Other general trends in the Federal Republic of Germany are, according to present findings and reports, the spread and utilization of analytical job evaluation and of systems involving predetermined times. (Cf Schmiede, Schudlich 1976, p 352 et seq.) But there is a need here to look more closely at differences in practice in individual companies.

For instance, although in the Federal Republic of Germany, as elsewhere, the introduction and use of analytical job evaluation is based on the "Geneva formula" and supra-company collectively agreed wage-category systems, in the individual industries and regional wage-scale districts varying methods of job evaluation are used which differ in particular as regards the definition and weighting of the evaluation factors. Secondly, generalized methods of analytical job evaluation have to be adapted to the circumstances of the individual establishment, and basic principles (or concrete arrangements) specific to the individual establishment have to be developed for the evaluation of individual tasks. Furthermore, the collectively agreed wage category systems also generally provide for greater differentiation of job characteristics, from the point of view both of qualifications and of stress (see below).

There is therefore a need to investigate in which fields of activity analytical job evaluation leads to greater differentiation of basic wage rates, and what other effects for companies and workers, in addition to differentiation in the allowance made for various demands and stresses, result from the use of analytical job evaluation.

If we take a detailed look at the introduction and use of systems involving predetermined times, such as the MTM method, we find not only that in practice establishments make (or can make) use of different methods but also that the "purpose" of their use by the establishment can vary greatly from case to case. A basic distinction to be made here is whether MTM is employed only in workplace design, work planning and advance

costing, or whether it is also used for the definitive fixing of standard times for work performance as a basis for output-related components of earnings. This also means that various combinations of the use of the MTM method and the "traditional" REFA method for determining standard times are possible. Secondly, it has to be borne in mind that in the Federal Republic, although with the traditional REFA system the fixing of standard times is based on time recording at the workplace, highly differentiated ranges of guide values for work planning and advance costing have been developed in this case, too.

In this study it will be shown, by examples, that methods involving predetermined times are in practice applied and combined with the traditional REFA method in different ways in individual establishments

C. Developments in work organization and production techniques in the Federal Republic of Germany

In economic and political discussion, changes in the wage payment policy of companies are often regarded as being the consequence and result of changed forms of work organization and/or production techniques. One instance cited is, for example, the introduction of highly mechanized and automated production techniques as the "cause" of the replacement of traditional piecework by premiums and contract wages (eg in the steel industry); or it is assumed that new forms of work organization (group working, job enlargement, etc) also lead to fundamental changes in wage payment practices (abolition of individual piecework, change-over to premium wages, etc). In fact, however, relations between work organization, production techniques and forms of wage payment as encountered in individual

industries and plants cannot be automatically assumed to be the general rule and interpreted as indications of universal trends. This applies both to (1) the assumed developments in production techniques and in new forms of work organization and their concrete implementation and spread, and to (2) the connection between work organization, production techniques and forms of wage payment.

(1) While the tendency towards an advancing mechanization and automation of production processes can be regarded as a general feature of industrial production and especially of developments in the Federal Republic of Germany, particularly since the mid-1960s, it has to be borne in mind that such developments do not follow any inherent "absolute laws" but are subject, in their concrete form and implementation in each case, to the specific interests of the individual company with regard to the deployment and utilization of labour and are also dependent on conditions of operation specific to the individual company. Secondly, mechanization and automation likewise do not follow any fixed "development stages" which are generally passed through, albeit with differences in timing, in basically the same manner in all companies and industries; on the contrary, their concrete form and their course is subject to the specific conditions attaching to different production and manufacturing processes in each case (eg assembly as distinct from so-called material-converting processes in, say, the steel industry or the chemical industry). Highly automated production processes such as exist, for instance, in the chemical industry, the paper industry or the steel industry, cannot therefore automatically be assumed to be typical of the present

or likely future course of mechanization and automation in the metal-using and electrical engineering industries. While it is true that there have been much stronger tendencies in recent years towards further mechanization and automation in fields of production (such as the assembly process in the electrical engineering industry) which are traditionally labour-intensive and had hitherto not lent themselves easily to mechanization and automation, there are many indications that the emphasis is if anything on partial forms of mechanization and automation confined to individual working processes (or, in the extreme case, to specific tasks) without any fundamental changes in the overall production process. A typical example of this is the replacement of individual manual assembly operations by so-called assembly robots.

A further aim of this study will be to use the examples selected to investigate such developments and the accompanying relations between production techniques and wage payment systems.

Nor must the introduction and trial of new forms of work organization, which have come to occupy a prominent position in the Federal Republic of Germany in connection with the discussion and government promotion of a humanization of work, be too readily interpreted as an indication of general trends (job enlargement, job enrichment, group working, etc). Firstly, such changes have hitherto been confined to individual companies and industries and, within these, to individual areas of production ("humanization islands"); secondly, it is questionable whether these developments are ones which will become firmly established and more widely adopted in the future. Detailed investigations show that, while companies certain-

ly are introducing new forms of work organization, a large proportion of these correspond only in individual aspects to the conceptions and examples on which the discussion and government promotion of a humanization of work is concentrated (eg the replacement of simple tasks by more complex and skilled tasks, the extension of workers' opportunities of exerting influence and taking action, etc). A characteristic feature of changes of this kind is that they do not conform to any "uniform" theoretical pattern and are applied in each case to certain "weak points" in the existing forms of work organization. They are part and parcel of the general, constant effort made by companies to ensure efficiency, step up productivity and solve organizational and personnel problems encountered in the organization of production and working processes. According to existing studies (cf Altmann and Düll 1980 (1978), p 87 et seq) the predominant features of such changes are (a) the transfer of production-line working, especially fixed-tempo production, to individual work stations and to some extent also group working, (b) the decoupling of human work from tempo constraints imposed by machinery or work organization, especially in the case of fixed-tempo production-line working, and (c) workplace design in accordance with ergonomic principles. In contrast to the government-promoted measures for the humanization of work, the measures adopted independently by companies consist largely of more routine and less spectacular changes in the existing forms of work organization and workplace design. Here again, the electrical engineering industry is a suitable and typical field for study.

D. Some features of the system of industrial relations in the Federal Republic of Germany

The scope that companies have for shaping the combination of production techniques, work organization and wage payment cannot be analysed independently of the present state and concrete forms of industrial relations. For the purpose of international comparisons in particular, this is an "influencing factor" which must not be overlooked or underestimated when considering and attempting to explain certain special features of developments in the Federal Republic of Germany. It is assumed that the reader is familiar with the dualistic structure of the representation of interests in the Federal Republic of Germany (representation of interests at supra-company level by trade unions, representation of interests within the company or plant by the works council) is assumed. Accordingly, when considering the effect of the representation of interests on company wage policy a distinction also has to be made between the usually supra-company arrangements arrived at by collective agreement and the range of influence within the company or plant afforded to works councils by law.

(1) The following are characteristic features of the arrangements arrived at by collective wage agreements for differentiation of basic wages in the metal-using industries. Firstly, the collective wage agreements (framework collective agreements) contain a distinction between different wage categories, job characteristics being distinguished according to the necessary training, the qualification requirements laid down and the stresses imposed by the work. This results in a classification comprising up to ten wage categories.

For work stresses, only a broad distinction is made between two levels of stress; there is a sharper differentiation with regard to the qualification requirements of jobs (in the case of skilled workers, for instance, up to four categories are distinguished). Secondly, however, the collective wage agreements also permit the use of other methods of job evaluation or analytical job evaluation instead of the wage categories, although the introduction of other methods of job evaluation is made subject to the proviso that, in addition to the works council, the parties to collective bargaining must also be consulted or their consent obtained. But the collective wage agreements also sometimes contain rules as to the methods to be employed for job evaluation (eg the framework collective agreement for industrial employees in the Bavarian metal-using industries); furthermore, some individual trade unions have worked out special procedures and scales which are employed in negotiations with companies and serve as guidelines for works councils.

An important point for an understanding of developments in PBR in the Federal Republic of Germany is the fact that, as far back as the 1920s, after initially resisting it the unions accepted the introduction of PBR and the use of the REFA method for fixing standard times and subsequently confirmed these by collective agreements. The agreement reached on "normal performance" as a reference quantity for fixing standard times has been a basic factor for developments after the Second World War. In practice, bargaining about standard times has become highly "formalized" and primarily a matter of the "correct procedure" and the necessary "expert knowledge".

It should be emphasized here that the unions hoped and believed that the REFA method would make it possible to arrive at a "fair" wage, since the fixing of standard times would no longer be subject to the "arbitrary action" of company managements (cf, for instance, Schmiede and Schudlich 1976, p 265 et seq).

The characteristic feature of the development of regulations governing PBR arrived at under collective agreements is that [1] the following forms of PBR (wage payment principles) are declared to be permissible in general: piecework, premium wage and flat rate with performance bonuses; their introduction is subject to agreements with the works council. A typical point about the regulations for fixing piecework rates is that they largely correspond to the procedures and guidelines developed according to the principles of REFA. For instance, they contain a definition of what is to be understood by normal performance and specify that account must be taken not only of the basic times but also of times allowed for personal needs, recovery times and rest times. In the rules on methods for determining standard times the main stress is on ensuring the existence of a basis for objective and verifiable time recording (work studies, job descriptions, etc). The collectively agreed regulations also provide for the stipulation of a guideline piecework rate.

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1) The general systems for the determination of wage payment principles and methods are laid down as a rule in framework collective wage agreements (Lohnrahmentarifverträge), which, however, often form part of overall framework collective agreements (Manteltarifverträge). The collectively agreed basic wages applicable in the individual case are laid down in the company or plant wage agreement.

Such regulations require that the piecework rate shall be fixed in such a way that, assuming normal performance, earnings shall reach an amount which is a certain percentage (eg 3.5% or 10%) above the basic piecework rate laid down under the collective agreement.

In this connection a characteristic feature of recent developments is an extended definition of "normal performance". The previously customary definition of normal performance as the performance that can be consistently achieved by any suitable worker after adequate practice and familiarization with the job has been extended by the addition of the words "without damage to health" (eg framework collective agreement for manual workers in the iron, metal-using and electrical engineering industries in Hesse, or the framework collective agreement for manual workers in the Bavarian metal-using industries) or by "arrangement of required working conditions that is fair in human terms" (Framework Collective Agreement II for the metal-using industries in North Württemberg/North Baden). A more recent and fundamentally more explicit collectively agreed regulation (hitherto confined to only one wage-level district) is that which lays down fixed periods for recovery times and times for personal needs (personal time allowance).

Instead of more general rulings such as "sufficient", etc, this stipulated a recovery period of five minutes per hour and a minimum limit for personal time allowances of three minutes per hour.

Under the collective agreements piecework rates (once they have been fixed) may be changed only in the event of changes of a technical nature, in the material or in working methods, or - under certain circumstances - in

the event of a change in the number of units to be produced or of mistakes in the evaluation of time recordings (calculation errors). For the settlement of "piecework disputes" the collective agreements provide for the appointment of so-called piecework committees, consisting as a rule of two representatives of the plant management and two expert employees, at least one of whom must belong to the works council.

In addition to regulations on the fixing of piecework rates, the collective agreements also contain regulations on premium wages and on performance bonuses in the case of flat rates. Here again the main emphasis is on the establishment of "objectifiable" methods. For the introduction and practical implementation of systems involving predetermined times the collective agreements contain an "enabling clause". This in principle "allows" the introduction of systems involving predetermined times, although sometimes subject to certain rules of procedure and earnings guarantees. Furthermore, not only the works council but also the parties to the collective agreement must be involved in their introduction.

(2) In the legal provisions governing the range of influence afforded to the works council (Law on the Constitution of Businesses - Betriebsverfassungsgesetz) the following points are of relevance for the questions with which we are dealing: in principle the works council has an enforceable right of co-determination in the changing of existing principles and methods of wage payment and the introduction of new ones (Article 87,

paragraph 1, subparagraph 10)[1]. Furthermore, under the basic legal provisions of 1972 the works council has rights of consent and initiative in respect of the establishment of all reference quantities for the determination of PBR, ie both as regards the determination and fixing of the time factors (eg in the case of standard times) and with regard to the field factor (Article 87, paragraph 1, subparagraph 11). These rights are, however, operative only where collectively agreed regulations exist. But the general obligation and right of the works council to keep watch on the observance and implementation of regulations established by collective agreement or by law also mean that it is incumbent on the works council, for instance in the application of the REFA method, to keep check on the fixing of "normal performance" and the application of the methods prescribed by collective agreement. A reminder should also be given here of the works council's participation in the piecework committee set up by collective agreement for the settlement of piecework disputes.

With respect to the use of analytical job evaluation the collective agreements or corresponding plant agreements also provide for the formation of a committee composed of equal numbers of representatives of the employers and the works councils, which has the task of differentiating the evaluations of the individual jobs in the plant. For the connection between changes in production techniques, work organization and wage payment, the

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1) The wage payment principle is the overriding formula governing all wage payment or a substantial proportion thereof for groups of employees; the wage payment method is the way in which a wage payment principle is applied (cf. Birkwald, R and Pornschlegel, H. 1973, p 232).

rights of the works council as specified in Articles 90 and 91 of the 1972 Law on the Constitution of Businesses are also of particular importance. Firstly, these articles laid down that the employer must inform the works council in good time of plans for the construction of new industrial premises or the conversion or extension of existing premises, for industrial plant, for working methods and sequences and for workplaces and must consult the works council about the proposed measures, especially with regard to their impact on the nature of the work and the demands on employees. (These rights of information and consultation are safeguarded and supplemented by further provisions relating to economic matters - including, for instance, rationalization schemes - and changes in operation - such as new working methods and manufacturing processes (Articles 106, 111 et seq of the Law on the Constitution of Businesses.) Secondly, the works council has a "corrective right of co-determination" with regard to the arrangement of working conditions that is fair in human terms. The works council can demand of the employer that changes be made if the workplaces, work sequence or working environment are manifestly contrary to "established work-science principles" concerning the arrangement of working conditions that is fair in human terms and the workers are consequently subjected to special stresses (Article 91). A factor of decisive importance for the practical effectiveness of these legal provisions is, however, the extent to which "established work-science principles" exist and what is meant both in the specific case and generally by the phrase "work-science principles". The interpretation of these expressions often proves in practice to be highly controversial.

Inasmuch as the arrangement of working conditions and work organization touches upon problems of health protection, it is both the right and the obligation of the works council to keep watch on the observance of the corresponding provisions established by law and by collective agreement and to participate in determining the plant's rules and practice in respect of health protection (protection of labour) (Articles 89, 87 paragraph 1, subparagraph 7 of the Law on the Constitution of Businesses).

II. The field covered by the inquiry

A. Importance and development of the electrical engineering industry in the Federal Republic of Germany[1)]

The electrical engineering industry as a whole presents a high degree of product differentiation and variability, ranging as it does from the building, equipping and maintenance of major plants, via private household appliances, to the microcomponent. Among the individual product groups, the one representing the highest proportion of production is capital goods, which in 1976 accounted for 56% of the industry's sales. In the same year the consumer goods sector accounted for about one quarter of production.

Except for mechanical engineering, the electrical engineering industry is the most important sector from the employment point of view in the Federal Republic of Germany.

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1) The information given here is mainly based on the data compiled in the 1979 Trade Union Research Project Group Survey (Untersuchung Projektgruppe Gewerkschaftsforschung)

The capital-intensiveness of the electrical engineering industry is much lower than that of other branches of the metal-using industries and is also, per employee, far below the average for industry as a whole. Hence a characteristic feature of this industry is a traditionally highly labour-intensive mode of production, which still exists to a great extent. In the 1970s, however, there was an above-average increase in capital intensiveness, indicating a growing general shift towards less labour-intensive forms of production.

The level of earnings in the electrical engineering industry rose between 1970 and 1976 by about 87%, thereby largely eliminating the discrepancy between the level of labour costs or incomes in this industry and in industry as a whole, which in 1970 still amounted to about 6%.

With regard to developments in productivity, it can be deduced from the available data that the volume of output per employee per hour worked was stepped up by 50% - much more than the average rise for industry as a whole - between 1970 and 1976. In contrast to the trend in capital stock, investment, volume of work and output, the rates of increase in productivity did not fall in the 1970s compared with the 1960s.

B. The group

1. General company-wide conditions

The group studied is one of the medium-large companies (5000-9999 employees) of the electrical engineering industry in the Federal Republic of Germany. This size category comprised 10 companies in the Federal Republic of Germany in 1978, employing 7.9% of the labour force

of this industrial sector (by way of comparison it may be mentioned that the 9 very large companies with over 10 000 employees accounted for 51.5% of the total labour force in this sector)[1].

At the time of the inquiry, the group owned several plants in the Federal Republic of Germany and one large plant in another EEC country.

The group manufactures electrical consumer goods. The products can be classified in the following product families:

Product family a: articles for personal use
Product family b: electrical kitchen appliances
Product family c: phonographic equipment
Product family d: photographic equipment

At the time of the inquiry, production was mainly concentrated on product families a and b.

According to information given by experts, the trend in sales in 1980 was according to plan, but the trend in profits was "unsatisfactory". Again according to the experts, the trend in sales differed markedly according to product family:

Product family a			+
Product family b		0 -	+
Product family c			-
Product family d			-

+ = rising; 0 = constant; - = falling.

1) Source: Zentralverband der elektrotechnischen Industrie e.V. (Central Association of the Electrical Engineering Industry), Frankfurt 1980, p 10.

In the case of certain products in product families a and b the group has a substantial share of the domestic market - it is the market leader for one product. Export business plays an important role in both product families.

2. The relationship of the plants to the group management

In economic decision-making, the individual plants have only a limited degree of autonomy in relation to the central group management. Within the group's internal organizational structure they have the status of "cost centres". Important economic planning decisions such as product planning and product development, long- and medium-term production planning, marketing, etc, are centralized in the group management.

On the other hand, the plants have a relatively wide margin of autonomy in the concrete arrangement of production techniques, work organization and labour utilization and, lastly, also in the practical application of wage payment principles and methods. But the group management does endeavour (as will be shown later on detailed points) to impose certain uniform guidelines for the determination of wage payments in the plants. One of the plants in Germany (Plant C) has a special status in that it is both organizationally and physically (same site) very closely integrated in the group management. It is the only one of the group's plants in Germany that has no independent personnel department; the interests of the plant's employees and those of the group management are represented by a joint works council. In the other plants the employees' interests are represented by a works council of their own. In addition, in accordance with the provisions of the 1972

Law on the Constitution of Businesses an overall works council composed of delegates from the plant works councils has been set up. By virtue of its legal form (Aktiengesellschaft - joint-stock company) and the number of its employees, the company is subject to the 1976 Law on Co-determination (the employees' side of the overall works council is represented on the board of directors).

3. General group guidelines for the development of work organization and wage payment

Despite the group management's general aim of making the internal organizational structures of the plants as uniform as possible, there are as yet no binding guidelines within the group for the determination of work organization and wage payment principles. There are several main reasons for this. Firstly, the group management does not wish the flexibility of responsiveness to the local conditions of the individual plants (which differ widely in some respects) to be impaired by excessive centralization. This applies particularly to the technical organization of production processes and the use and development of different forms of work organization.

In the past a number of experiments in the development and introduction of new forms of working have been carried out in some plants. The initiatives for these came mainly from the plant managements or from their supervisory staff. For instance, at Plant D (which could not be included in the inquiry - further information on this is given below) considerable efforts were made in the mid-1970s to introduce "semi-autonomous groups" in the assembly department, but the associated measures turned out to be a failure and most of them

were dropped. At Plant A several systems of keeping a buffer stock of workpieces or workpiece holders were devised with the object of decoupling the execution of the work at production-line positions from the flow of material. As will be shown in detail later, these experiments were still being systematically continued at the time of the inquiry (cf Chapter III). But at the other plants too, at least sporadic attempts have been made at devising alternative forms of traditional production-line work stations.

Secondly, it should be borne in mind that the individual plants are located in different wage-scale districts (the four plants in Germany are scattered over three districts) so that the shaping and concrete implementation of wage payment principles and methods are subject from the outset to different binding conditions arrived at by collective agreement. Furthermore, in addition to the framework collective labour or wage agreements applicable in the different wage-scale districts, circumstances also differ as regards industrial relations.

The group management is, nevertheless, endeavouring to achieve uniformity in the application of wage payment principles and methods in the individual plants in so far as the collectively agreed employment conditions permit and in so far as it appears reasonable in view of the different production structures and labour utilization conditions in the individual plants. The line taken by the group mainly consists, however, of a retrospective systematization and harmonization of developments which have occurred in the individual plants. The group management adheres in general to the principle of PBR for manual workers, and this includes high-technology assembly and production processes where the individual worker nowadays has but little scope for

influencing output by his own performance. It is feared that there would be a general decline in performance if the principle of PBR were abandoned. It is the group management's intention that the flat rate shall be increasingly supplemented by performance bonuses based on analytical performance evaluation (at the time of the inquiry the group management was also endeavouring to introduce principles of PBR in its foreign plant, where all employees have hitherto been paid on a flat-rate basis).

C. The plants studied

Three of the group's plants located in Germany were included in the inquiry; these represent the major domestic producers for the articles in product families a and b.

The three plants all differ greatly from each other as regards local conditions and in some respects also display considerable variations in their internal structure. The following brief descriptions are summary in nature, covering only the most important framework conditions and structural characteristics of the individual plants, namely: products and production structure, situation on the product market, labour market situation, work-force structures, general features of wage payment principles and methods, and organization of employees' representation in the plant. More detailed information and descriptions are given in the individual analyses (see below, Chapter III).

1. Plant A

a. Products and production structure: end products of product families a and b. About 100 product variants

(mainly designed to conform with the different requirements of the countries to which they are exported), including 60% in large-scale series production (over 200 000 units per year) and 40% in medium-scale series production (50 to 60 units per year).

High degree of mechanization and automation in manufacture of parts; both assembly of sub-assemblies and final assembly predominantly manual; production-line organization throughout the assembly department with various buffer-stock systems ("decoupled" production-line work stations).

b. Product market situation: good overall market situation in both product families. High proportion of exports. Sharp seasonal fluctuations in demand. Frequent product innovation.

c. Labour market situation: favourable overall labour market situation in a domestic labour market with little competition. No recruiting difficulties as regards semi-skilled labour but difficulties in obtaining skilled workers.

d. Work-force structure: about 850 employees, including 720 manual workers = 85% and 130 technical and commercial staff (approx. 15%). Proportion of skilled workers in manual work-force = 15% (mainly toolmakers). All others semi-skilled. Large proportion of female workers, especially in assembly work (total proportion of women 65%), small proportion of migrant workers (under 10%). Low labour turnover (annual rate of turnover below 10%), absenteeism through illness 6 to 8%.

e. Wage payment principles and methods: in assembly work, partly piecework as a "standardized" incentive

wage, ie for fairly long periods at fixed rates, partly "free" individual piecework; in parts manufacture, mainly "standardized" piecework. Flat rate without performance assessment (but with shift and dirty-work allowances) for skilled jobs; distribution: piecework = 84%, flat rate = 16%. Differentiation of basic wages is according to collectively agreed wage categories. Standard times calculated partly according to MTM and partly according to REFA. Predominant wage category: wage category 2 (approx. 70%).

f. Representation of employees' interests: 11 members of works council, one full-time. Low degree of unionization (10%).

2. Plant B

a. Products and production structure: end products of product family a, only one kind of product. The product is manufactured in 16 basic types with a total of 105 variants.

The manufacture of plastic parts is for the most part fully automated. There is also a high degree of mechanization and automation in the manufacture of metal parts, and also in the assembly of some sub-assemblies. Assembly of products in large-scale series production is semi-automated in many cases, while for medium-scale series production assembly operations are chiefly manual.

b. Product market situation: good to very good. The company is the market leader in this product sector and has a market share of 60%. Large proportion of exports. Relatively steady demand.

c. Labour market situation: very good labour market situation, with a quasi-monopoly position in a rural labour market. No recruiting difficulties, even for skilled workers.

d. Work-force structure: total work-force of approx. 1200 employees, including approx. 1000 manual workers (85%) and 130 technical and commercial staff (11%) (remainder: commercial and technical trainees). The work-force had been increased by 200 at the end of 1979. Proportion of skilled workers among manual workers approx. 14% (mainly toolmakers and toolsetters), all others semi-skilled. Proportion of female workers in total work-force 56%. Low labour turnover (annual rate approx. 5%). Absenteeism through illness averages 10 and 12%, low proportion of migrant workers (approx. 11%).

e. Wage payment principles and methods: in production, mainly PBR in the form of a piecework rate with a fixed ceiling, referred to in some parts of the plant as a productivity premium and in others as piecework. In addition, flat rate with performance bonuses based on analytical performance assessment, chiefly for skilled jobs; distribution: "premium wage" approx. 80%, flat rate approx. 20%. Differentiation of basic wages is based on collectively agreed analytical job evaluation. There are 14 job evaluation categories. Standard times determined by the REFA method.

f. Representation of employees' interests: 15 members of works council, including two full-time; degree of unionization 50%.

3. Plant C

a. Products and production structure: production is mainly concentrated on the manufacture of components and assembly of sub-assemblies for the other plants. At the time of the inquiry, production of articles belonging to product family c was transferred to Plant C from a plant that had been closed down. In parts manufacture, some processes are highly mechanized and others fully automated. In assembly of sub-assemblies, some processes are partly automated; other assembly work is predominantly manual (individual working).

b. Product market situation: owing to the plant's special position as "supplier" to the others, the market situation depends on demand in the product families in question. As mentioned, demand for products in product family c, the manufacture of which has been transferred to this plant, is falling off rapidly.

c. Labour market situation: the labour market is characterized by its nearness to an industrial conurbation. The recruiting situation, which up to the mid-1970s was difficult in the regional labour market for all the categories required, has eased in recent years. Nevertheless, considerable difficulty is still experienced in recruiting skilled workers.

d. Work-force structure: total-work force 690 employees (plant and group administration), including approx. 450 (= 65%) manual workers. The size of the work-force has remained relatively stable in recent years. High proportion of migrant workers (approx. 70% - main nationality group Turkish), approx. 18% skilled workers or

workers classified as being of similar status[1] (mainly toolfitters). Proportion of female workers approx. 60%. Low turnover (approx. 10% per year). Absenteeism through illness 15% on average, 17% in assembly.

e. Wage payment principles and methods: three wage payment principles are applied for manual workers: piecework (individual piecework), productivity premiums with proportional wage line (individual premium) and flat rate with performance bonuses based on analytical performance assessment. Distribution: piecework approx. 40%, premium wage approx. 19%, flat rate with performance bonuses approx. 41%. Differentiation of basic wages is according to a plant regulation based on analytical job evaluation corresponding to the system from a different wage-scale district. There are 12 job evaluation categories, but workers fall within only categories 3 to 11. The majority are in categories 3 to 5.

f. Representation of employees' interests: 19 members of works council (including group administration), high proportion of white-collar employees, two full-time members of works council; degree of unionization of manual workers approx. 50%.

III. Selected relations between work organization and wage payment in the plants studied

A. Introductory comments

The purpose of the following case analyses is to take

1) Estimated proportion for the plant, based on the breakdown of workers among the job evaluation categories.

selected working processes as examples to illustrate a number of typical relations between production techniques, work organization and wage payment. It goes without saying - since all our cases are within the context of a single company - that "typical" cannot be taken as meaning representative; it means merely that the selected relations are considered to have a general significance extending beyond the individual case.

In our choice of the working processes studied and of the typology employed as the basis for analysis and interpretation, we took our cue from the general trends in the interrelation between production techniques, work organization and wage payment as described in Chapter I and from the more general range of problems - confined in this case to the field of the electrical engineering industry - which they raise.

Our line of inquiry was directed firstly towards working processes that involve a large proportion of manual operations and have been the subject, at least tentatively, of special work organization measures and secondly, by way of contrast, towards manufacturing and assembly processes characterized by advanced production technology: a high degree of mechanization, partial automation or full automation. For reasons of comparison, however, the study also includes working processes with traditional structures as regards work organization - in the form of traditional production-line working or conventional production techniques in parts manufacture (eg individual machine operation). In all cases we set out to establish what wage payment principles and methods were associated with working structures that differed so greatly in their technical organization and work organization and to discover what considerations

and interests of the plants concerned are of decisive importance in this connection. In the case analyses given below the relations that we highlight as being relevant to an assessment of current developments are as follows:

- Type I is characterized by the connection between changes in work organization in production-line working that are aimed at providing stronger encouragement for individual work performance, and the introduction of the "traditional" individual piecework system. The function of the wage payment system here is to mobilize performance reserves which are potentially released by the work organization measures.

- Type II is characterized by the combination of partly automated assembly processes with PBR systems in which the wage incentive is subject to an upper limit in the form of a "cut-off" piecework wage or a productivity premium. The main object of retaining the incentive wage is to ensure high performance by workers in operations through which output can still be influenced (feeding machines, avoiding stoppages, remedying faults).

- Type III is the linking of traditional forms of individual working at assembly work stations with a "frozen" piecework rate where the incentive wage is subject to a ceiling. The function of this wage payment system is to ensure the steadiest possible overall performance, to maintain flexibility in the utilization of labour and to ensure that the wages structure within the plant does not become distorted by the trend in actual earnings.

- Type IV is characterized by the connection between highly mechanized or fully automated manufacturing and assembly processes and a fixed wage or a PBR system that is tantamount to a fixed wage. In the analysis of this type, the aim is to examine the question of what function, if any, PBR still has in the case of work processes where the proportion of time during which the worker can exert any influence tends towards zero.

It must be emphasized that this typology, which was arrived at empirically on the basis of our case material, does not claim to cover all possible and empirically relevant combinations between work organization and wage payment. For instance - to indicate just one omission - it systematically ignores the relation between forms of work organization which (as in the case of group working) aim at giving a greater stimulus to co-operative work performance, and group-related wage payment systems (such as group piecework or group premium wage). This combination was found to be virtually irrelevant in the cases included in this inquiry (but there are some pertinent empirical results from an earlier inquiry, and these are taken into account, as a subsidiary factor, in the interpretation).

The forms of combination between production techniques, work organization and wage payment as covered in these types are represented in the plants investigated as follows:

Type I - Plant A
Type II - Plant B/C
Type III - Plant C/B
Type IV - Plant A/B/C

B. Decoupled production-line work stations and free individual piecework - Type I (Plant A)

1. The importance of Type I within the field covered by the inquiry

The form of combination between work organization and wage payment system studied in Type I is of importance primarily in cases where there is a predominantly labour-intensive method of production which is not (or cannot be) basically changed even for a short time, but where also the traditional forms of work organization (eg production-line working) can produce no further increase in "efficiency". The analysis of Type I shows that the decoupling of traditional production-line working - which is also regarded, in public discussion, as a contribution towards the humanization of work - in the company's interest at the same time creates conditions permitting the (re-)introduction of traditional piecework (free individual piecework).

Within the field covered by the inquiry the form of combination between work organization measures and wage payment that is characteristic of this type was encountered primarily in the final-assembly department at Plant A. The work processes here still include a large proportion of manual operations; a large proportion of the periods of time that make up the working sequence can be influenced by human work performance. Final assembly is of central importance in the production structure of Plant A.

2. Changes in work organization in final assembly

Originally, the lines for final assembly of the products at Plant A were designed in accordance with traditional principles of production-line working.

There were seven fairly long assembly lines on which, depending on the product type, 30 to 40 workers were employed. The individual assembly operations followed each other in succession on the lines; they consisted of simple joining-together, adjusting, checking and packing operations with very limited job content and an average cycle time of 0.5 minute. The workpieces were carried along by a mechanically driven belt. Although the conveyor belt did not impose any mechanical work-pace, there was a work-pace constraint in that the depositing positions were marked on the belt. This traditional form of production-line working was designed to produce a constant average performance and in principle excluded increases in individual performance at the individual work stations. The wage payment principles applied also corresponded to this: while the workers were formally paid on a group piecework basis, earnings were in fact frozen at a level 25% above the collectively agreed basic wage and were actually tantamount to a fixed wage. The purpose of the "standardized" PBR represented by this group piecework system was to keep the average performance of the assembly lines as steady as possible.

The main feature of the changes in work organization is that the production-line work stations are decoupled from the flow of materials by the creation of large "buffer" areas. Within the limits of the buffer capacity (between 20 and 60 minutes) the workers can maintain their working rate and individually step up their performance independently of the output of the work stations preceding and following them. At the time of the inquiry five of the seven assembly lines devoted to final assembly of the products had been converted in accordance with this principle of work organization. A total of about 200 workers were affected. Two differ-

ent technical solutions were adopted for the conveyance of the workpieces (circulation buffer, intermediate buffer): a common feature of both solutions is that the conveyor system is designed to serve at the same time as the buffer area.

At the time of the inquiry four assembly lines had been converted in this way; we investigated that solution which, in the opinion of the plant's experts, has proved its effectiveness and is regarded as sufficiently promising for further development.

As on a traditional conveyor belt, the work stations have been arranged in a line following the correct sequence of assembly operations. However, the conveyor system is so designed that three levels are available at different heights. The top level is used for actually conveying the workpieces, or, more precisely, the pallets in which workpieces and materials are placed. The middle level is the actual buffer area, while the lower level is intended for the return of the empty pallets but can also, if necessary, be used as an additional buffer section. The worker takes the workpiece from the pallet, performs the appropriate operation and replaces the workpiece in the pallet. If the buffer accommodation between the work stations is exhausted on the upper level (two or three pallets), the worker places the pallet in the middle level.

It should be emphasized that the sole purpose of this work organization measure is to decouple the production-line work stations. It does not involve any further changes, such as an extension of the work content in the sense of job enlargement and job enrichment, nor any real increase in the qualification requirements; and the cycle times (mostly less than one minute) have not been

appreciably changed either. The work on the assembly lines still consists of short-cycle repetitive sub-operations of the kind characteristic of traditional production-line work stations in assembly processes with a high proportion of manual operations.

An example of this is the assembly of a kitchen appliance for chopping-up, mixing, cutting and slicing operations in the home, produced in two basic models and with several accessories. There is a wide range of variants owing to the specific acceptance conditions imposed by the individual countries to which the product is exported.

The assembly process can be divided into a total of seven successive assembly stages; fitting together parts in connection with individual pre-assembly tasks; screwing the motor into the housing; fitting the base-plate and switch assembly; fitting the mixing blade; finishing off the upper part; testing; final packaging. The assembly tasks consist of simple manual joining operations (screwing, pressing in, etc), which are performed with simple devices and tools. The testing activities mainly consist of reading measured values on measuring instruments. The purely manual packing operations are primarily characterized by somewhat greater physical demands.

The cycle times range between 20 seconds and 1 minute; in addition, supplementary tasks (for instance, stamping the appliance number in the instruction book) are performed at a few assembly work stations. Some assembly operations (screwing in the motor, finishing off the upper part) are performed at dual work stations.

In the arrangement of the work stations along the converted assembly lines, systematic use has been made of methods of workplace design according to MTM principles. These relate in particular to the optimization of reaching distances and provision for bi-manual working, and also to ergonomic considerations in workplace design; for instance, most of the workplaces are arranged so as to allow the work to be done alternately sitting and standing.

Whereas the work organization measures have had relatively little influence on the content and amount of the work, they have had decisive consequences for the use of the workers at the work stations. To ensure that the decoupled working system made possible by the buffer areas can continue to function, the workers have to be prepared for constant changes of work station. Generally speaking, the individual worker can only influence the work-pace within the limits of the existing buffer capacity. If a buffer area preceding the work station has become "empty" or a buffer area following it has become "full", individual work performance becomes tied to the workers' average performance once again and the effect achieved by the buffer storage of workpieces is lost. The quicker worker therefore has to change places with a slower worker in order to refill a buffer area that has become "empty" or re-empty one that has become "full". Only by constant changes of work station can a continuous flow of material be maintained in the assembly lines; at the same time, the workers can only increase the proportion of their individual output in the day's performance by frequently changing work stations.

The constant need to change work stations increases the demands made on the workers on the converted assembly lines inasmuch as they have to be capable of working at

several work stations in the line. Despite their acquisition of the ability to perform several tasks, the level of qualification attained by the assembly workers must not be overestimated, since the qualifications demanded are in all cases very slight - as a rule no specialized knowledge is assumed (exceptions: adjustment work stations and, above all, repair work stations). Apart from the manual dexterity required, the demands made by the work consist essentially of demands as regards pace of work and high demands as regards concentration; these are heightened by the familiarization difficulties encountered upon each change of work station. It should also be borne in mind that the initial training and familiarization periods for newly appointed workers amount to only two to four weeks on the assembly lines, one to two weeks for testing activities and just a few days for packaging activities. The boundaries between training (which takes place on the job) and familiarization are fluid.

In the case of workers transferred from other assembly lines, and also from other sections of the plant, the initial training and familiarization period is reduced to a few days.

3. The change in wage payment principles and methods in Case A

a. The differentiation of basic wages at the decoupled production-line work stations

The differentiation of basic wages is entirely governed by the wage category rules of the relevant framework collective agreement. The workers are "summarily" allocated to the collectively agreed wage categories in accordance with the job characteristics contained in the

wage category rules[1]. The overall increase in work requirements at the decoupled production-line work stations has not led to a higher categorization of the workers concerned or a resultant increase in their basic wages.

As previously, the assembly workers, including testers, are all classified in wage category 2 (out of a total of 10 categories) of the scale under the relevant framework collective agreement. The only exceptions made are for packaging positions requiring comparatively hard physical effort (wage category 4) and for repair work stations (repairs to fully assembled units), which while physically included in the assembly lines, are not integrated in the actual assembly process (wage category 5).

The job characteristics contained in the relevant framework collective agreement actually have the effect of making it difficult to take into account, in assigning the workers to wage categories, the specific work and performance requirements entailed through the changes of work station that are necessary at the decoupled production-line work stations. As the individual assembly operations have only limited job content and require little skill, the necessary readiness to change work

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1) The wage category classification laid down under the relevant framework collective agreement is characterized by a combination of job characteristics relating to requirements or qualification and job characteristics relating to working stresses. Depending on the level of working stresses the wage category allocation for unskilled, semi-skilled and skilled workers displays characteristic jumps in the wage categories.

stations and to acquire the ability to perform several jobs cannot easily be covered by the rather traditional qualification characteristics (training time on the one hand, degree of difficulty of the job on the other) on which the wage categorization under the framework collective agreement is based[1]; furthermore, it is difficult in principle to express increased mental and psychological stresses connected with the changes of work station in terms of the stress levels specified in the framework collective agreement.

Although some of the experts questioned thought that it would be desirable to have, in the assembly department as elsewhere, a greater differentiation of basic wages "more consistent with the job requirements", it must not be forgotten that from the plant management's point of view a levelling-out of basic wages on the assembly lines with a resultant "permeability" of wage categorization is highly desirable, since greater differentiation of basic wages would make it far more difficult to transfer workers within or between assembly lines. One reason for this is that, as experience has shown, workers are reluctant (despite earnings guarantees) to move to work stations with low evaluations; secondly, frequent and short changes of work station and transfers to work stations with different evaluations, apart from creating greater problems in wage accounting, tend to push up the plant's labour costs because the workers, under guaranteed-earnings clauses in collective agreements, always take the higher wage category "with them".

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1) The reference basic wage is wage category 7 (= 100%) for skilled workers over 21 years of age with the highest geographical weighting.

The plant management therefore again rejected original proposals that the differentiation of wages should be based not on collectively agreed wage categories but on analytical job evaluation, on the grounds that greater differentiation of basic wages according to specific job requirements would detract from the existing permeability of wage categories in the assembly department without reducing the total cost of basic wages - it being in fact feared that there would be a higher proportion of up-valuations of jobs than of down-valuations. Furthermore, plans in this direction put forward by management met with determined resistance from the works council.

b. "Free" individual piecework

"Free" individual piecework was introduced on the basis of a plant agreement in 1977. The piecework system was initially a system of "individually calculated" traditional REFA piecework on standard time: the piecework earnings, ie the performance - or result-related wage component - rises in proportion with output.

The introduction of a "free" individual piecework system thus merely means that no upper limits are set to individual piecework earnings; hence, the workers can be paid for increases in output which are substantially above the average performance.

Contrary to the classical theory of free individual piecework, this plant also applies a lower limit for individual work performance, which is measured according to the average performance or the management's expectations with regard to this average. Independently of the question of possible loss of earnings, it is to be assumed that, in the event of persistent under-perform-

ance by workers, plant managements will as a rule take disciplinary measures of varying severity (transfers, moves to other departments, and also dismissal where appropriate). This point, which is of great importance for the utilization of low-performing workers, will be discussed in greater detail later.

Whereas under the previous "standardized" system of PBR the workers' piecework earnings amounted to 125% (ie 25% above normal performance as defined by REFA and put at 100%), the introduction of "free" individual piecework on the converted assembly lines initially resulted in a marked increase in the workers' average earnings and a relatively wide range of variation of individual earnings.

Under the 1977 plant agreement, free individual piecework was initially introduced gradually on the first two converted assembly lines. Only a few months after the "freeing of piecework" the average performance index was up to about 140%, with the performance indices achieved by individual workers ranging from 115 to 160%.

By the time of the inquiry, on the other hand, the average performance index achieved by workers on the converted assembly lines had settled down to values of between 130 and 135%. Even at that time there were still "outliers" with performance indices of 160% and higher, but, in the unanimous opinion of the experts, these were isolated cases. The normalization of the range of fluctuation of performance indices is primarily attributable to a change in the methods of determining the standard times. (On this point, see also c)).

It should be mentioned that accurate allocation to individuals of the performance indices they achieve at each of

the work stations requires a sophisticated system of data recording in the working process. At Plant A this allocation is based on the use of wage slips which show, in addition to the order number, work allocation, standard time, etc, also the personnel number, date, output, rejects and the exact starting and completion times of the jobs. On each change of work station the worker "draws" a corresponding wage slip, and when the work has been done he/she reinserts it, whereupon the personnel number, starting and completion times, etc, are recorded by a recording clock.

c. Changed methods of determining standard times

The use of systems involving predetermined times for working out standard times was introduced in Plant A under a plant agreement of June 1979. This plant agreement states that MTM synthetic values can now be used to determine the so-called basic times (but MTM is not used for determining material-delay times and personal-needs times, rest times and process times). For the application of MTM synthetic values for determining basic times, a correction factor of 1.13% compared with the REFA times was agreed upon between the plant management and the works council (see also under Section 4).

Time determination is mainly based on the MTM basic method, which has however been adapted, with appropriate refinements, to the particular conditions of use at the plant.

At the time of the inquiry the determination of standard times according to MTM synthetic values was therefore confined to the converted assembly lines. Although the plant management is endeavouring to extend the use

of MTM methods for determining standard times, the plant experts consider that this will require prior measures of work organization and workplace design, especially on the traditional conveyor-belt production lines which still exist.

Lengthy advance preparations for the use of MTM synthetic values for determining standard times had been made by the plant management (with the support of the group management). The plant management ran MTM training courses which were also attended by representatives of the works council. The object of this was to ensure the existence of the necessary "specialized knowledge" on "both sides". MTM synthetic values had been used for advance costing in launching new products even before the "official" introduction of the MTM method for determining standard times. According to the company's experts, this resulted in the achievement of a very high degree of accuracy in comparison with the REFA times subsequently recorded. The plant management thus had a considerable amount of know-how in advance on the use of the MTM method.

4. Influence of the works council and the trade union

It should be stated at the outset that, in accordance with the provisions of the Law on the Constitution of Businesses, the works council at Plant A was formally involved both in the changes in work organization and in the change in the principles and methods of wage payment. However, the actual amount of influence exerted by the works council on the changes in work organization and in principles and methods of wage payment differed to an extraordinary extent from case to case.

On the whole, the influence of the works council on the changes in work organization was in fact slight. In principle the works council was in favour of decoupling the production-line work stations by creating buffer areas, as it expected that the conversion measures would have "humanizing" effects for the workers. In its opinion, the application of MTM principles in the design of these workplaces constituted sufficient observance of ergonomic principles (or established work-science principles). The works council therefore considered it neither possible nor necessary to exercise its corrective right of co-determination under Article 91 of the Law on the Constitution of Businesses.

The works council was likewise in favour of the introduction of "free" individual piecework. It expected that this would result not only in improvements in the workers' earnings but also in payment "more fairly reflecting performance".

For these reasons the works council offered no real resistance to the plant management's wish to introduce "free" individual piecework by a plant agreement.

Although in giving its consent to the introduction of "free" individual piecework the works council was fully aware of the danger of workers overexerting themselves, with the concomitant long-term effects of impaired health and reduced performance, it believed that it would be able to counteract this danger by an appropriate information drive within the plant.

Nor did the works council fundamentally oppose the introduction of MTM for determining standard times; however, it made its consent to this dependent on the

application of the correction factor in relation to the original REFA times. It should be borne in mind here that the relevant framework collective agreement stipulates that "the introduction of time and motion methods for determining standard times must be agreed with the works council in consultation with the parties to the collective labour agreement (Framework Labour Agreement for Industrial Workers dated 1 December 1973, Bavaria, Annex 2, Section 9, in respect of Article 22).

Under the previous system of fixing piecework rates according to the REFA method, although disputes about the estimated performance index were in fact confined to exceptional cases the works council consented to the freeing of piecework in individual cases only when all the standard times worked out for all work stations on the individual assembly lines had been submitted to it and the preconditions for the freeing of piecework that were necessary from the point of view of work organization were seen to be fulfilled. (Up to the time of the "freeing of piecework" the workers were paid, under the plant agreement, on the basis of the existing "standardized" PBR scheme.)

The negotiations concerning the introduction of MTM for determining standard times, in which the competent local district administration of the Metal-Using Industries Trade Union participated, went on for over a year. While the plant management offered a conversion factor of 1.07, the works council - in accordance with trade union target levels that had in fact been won in some major companies - demanded a conversion factor of 1.30. In addition, the works council demanded that the plant agreement to be concluded should include the stipulation of a rest time of five minutes in the hour (on

this point the works council invoked a corresponding provision of Framework Collective Agreement II in North Baden/Württemberg, but this agreement is not applicable to the wage-scale district in question).

Finally, the works council (without the intercession of the competent district administration of the Metal-Using Industries Trade Union) agreed to a conversion factor of 1.13%. In the plant agreement, 0.03 percentage points of this conversion factor are explicitly identified as rest times - the plant agreement states that this component of the conversion factor cannot be revoked even if additional rest times are introduced in the relevant framework collective agreement. The plant agreement furthermore states that workers' "training-effects" must not be used in order to shorten times. Changes in standard times may be made only in the event of demonstrable changes in methods or errors in calculation.

5. Company motives, effects and problems associated with the change in work organization and wage payment at Plant A

a. Motives

The company motives for the change in work organization and wage payment can be basically summarized as follows:

1. Changes in work organization. The group is seeking to safeguard and reinforce its existing positions on the relevant markets in a generally more keenly competitive situation by means of product innovation and product diversification, which are observable to a particularly marked extent in product family a. This

imposes special requirements for flexibility in work organization and labour utilization at Plant A, particularly since demand for the products is subject to sharp seasonal fluctuations.

The combination of traditional forms of production-line working with a "standardized" system of PBR gave rise to the following main problems for the plant in this connection:

- In order to ensure constant performance at all production-line work stations, the individual rates of working had to be closely co-ordinated. This gave rise to fundamental difficulties in the construction of the products (in which industrial design and user convenience take priority over technical production considerations).

- Co-ordination of rates of working was made more difficult by the frequent changes in types and variants and the need to start manufacturing newly developed products. On the whole the rigid conveyor-belt organization proved rather unresponsive to flexibility requirements imposed by the market; considerable losses resulting from a lack of co-ordination in rates of working were incurred when changing over from one production series to another.

With the traditional conveyor-belt organization, hold-ups that occurred at individual work stations could easily spread to the whole line and lead to production stoppages.

The company is seeking, in particular, to achieve the following aims by the changes in work organization on

the assembly lines:

- to reduce losses resulting from a lack of co-ordination in rates of working, minimize hold-ups and at least limit the effects of individual hold-ups in the assembly lines;

- to allow greater flexibility in the utilization of labour.

2. Change in wage payment principles and methods

As has been said, the changes in work organization on the assembly lines were bound up from the outset with the company's aim of introducing a "free" individual piecework system in place of the "standardized" PBR system. This aim on the part of the company was primarily due to the generally disappointing results experienced by the management representatives with a wage payment system that provided no earnings incentive. According to their estimates the "performance index" achieved on the traditional assembly belts was about 10% below the guaranteed earnings level of 125%. The management representatives considered this to be due not only to a "rigid" conveyor-belt organization which excluded the possibility of individual increases in performance but also to a general hampering of performance: with a rigid production-line form of organization the work-pace is ultimately determined, they asserted, by the slowest worker. The workers' reluctance to change work stations was also mainly attributed to the absence of any earnings incentive.

At the same time, however, the company tried to keep control over the development of piecework earnings by changing the methods for determining standard times:

the calculation of basic times according to MTM synthetic values has a distinctly standardizing effect on the workers' piecework earnings. Although the use of MTM methods for determining standard times does not exclude the possibility of fluctuations in the performance index achieved by the workers, it should be noted that since the introduction of MTM methods the proportion of very high performance indices on the converted assembly lines has declined, ie that "outliers" have become rarer - so that the danger of "piecework earnings getting out of hand" has been appreciably reduced. The introduction of systems involving predetermined times should in fact also be viewed mainly in connection with the requirements the market imposes for flexibility in the arrangement of work processes.

The plant experts gave the following main reasons for the introduction of the MTM method for determining standard times:

- It eliminates the need for "on the spot" time recording, which has always been found to cause anxiety among the work force.

- When the manufacture of new product series is being started, the "correct time" can be introduced from the outset - the works council is no longer able to delay the freeing of piecework.

- In the event of changes in product design or workplace design (methodological changes), revisions of individual times can be carried out without the need for an overall review of standard times.

- The method of time determination is considerably simplified. Long-term rationalization effects can be expected in the "time-study" department. For instance, when there are changes in products, the standard times can be much more easily adapted to corresponding changes in the work sequences, and when the manufacture of new products is started the definitive standard times can be more quickly determined. This also means that better planning figures are available to the management.

b. Effects and problems of changes in work organization and wage payment for the company

In the first place it should be noted that the changes in work organization are associated with conspicuous gains in profitability for the company. These gains, which arise from the reduction of unproductive times (losses resulting from lack of co-ordination in rates of working, and losses due to hold-ups) and the savings in labour costs achieved by the elimination of stand-by workers, are estimated by the experts at 6 to 8%.

The introduction of free individual piecework means an overall improvement in the "performance balance sheet" for the plant. From this angle the management representatives consider that the introduction of systems involving predetermined times for working out standard times also has a favourable effect for the company. The run-in periods on the introduction of new products have become shorter, more reliable data are available for production planning and costing - the overall "performance level" has risen.

Despite the favourable overall effect, the company is still faced with a number of problems which in some

respects have been made more acute by the change in work organization and the introduction of new wage payment principles. These are as follows:

1. There is a fundamental conflict between variations in the number of units produced as a result of the "freeing of performance" and overall planning in the plant, which is based on constant planning figures (numbers of units). Not only does this conflict lead to frequent imbalances between component production and assembly (bottlenecks of material), but the variations in the number of units produced also make it harder to co-ordinate sales and production. According to the experts, this co-ordination generally has to be based on the assumption of a range of fluctuation of 15%.

2. Although the changes in work organization have indeed allowed greater flexibility to be achieved in the utilization of labour on the assembly lines when changes are made in products and production series, the work organization structures, which are of course still based on principles of production-line working, remain fairly unresponsive to seasonal fluctuations in demand. Peaks in the volume of orders can still only be coped with by resorting to overtime, special shifts and the use of "seasonal workers". The scope for dealing with temporary fluctuations in demand through flexibility in the time structure of labour utilization (such as changing from part-time to full-time employment, etc) is greatly restricted by the terms of collective agreements and employment contracts.

3. The "freeing of performance" on the converted assembly lines aggravates the problem of the utilization of low-performance workers. Although the free individual

piecework system theoretically also allows "downward" fluctuations in performance, it goes against the company's interest in achieving the highest possible average performance if the performance of individual workers at the decoupled production-line work stations consistently falls short of the average performance (apart from which, excessive fluctuations in the performance index make it harder for the buffer systems to function effectively. The management endeavours to ensure the highest possible average performance on the converted assembly lines by prior selection of the personnel who are to work on them. As a general rule, "higher-performance" workers are used at the decoupled production-line work stations. Lower-performance workers are transferred to assembly lines with traditional conveyor-belt organization or to other sections of the plant (there is talk of creating special work stations for older workers).

4. The "freeing of performance" and frequent changes of work station also aggravate the problem of ensuring product quality. It should be borne in mind here that the group sets very high quality standards for its products (these apply not only to the functional efficiency of the appliances but also to accurate connections, surface finishing, etc). Rapid rates of working and familiarization difficulties experienced by workers because of changes of work station or production series increase the risk of errors in assembly. The plant management had previously attempted to enforce observance of quality standards by disciplinary measures - errors in assembly incurred sanctions against the workers (correction of faulty work without payment, publicly displayed lists of faults, warnings, threats of dismissal). This approach engendered considerable conflicts within the plant and was on the whole unsuccessful. The plant management is now

endeavouring to resolve the conflict between "freeing of performance" and "quality assurance" both by the use of deliberate forms of incentive (giving workers more helpful information, praise, etc) and also (more particularly) by improved quality planning (better inspection, more efficient machine minding, workplace design, etc).

C. Partial automation of assembly work and tendencies towards fixed wages - Type II (Plant B)

1. The importance of Type II within the field covered by the inquiry

Whereas Type I is specifically characterized by the fact that changes in work organization and wage payment are intended to release and mobilize reserves of performance potential, the aim in Type II is to ensure steady output with a relatively advanced - but still partial - degree of automation in assembly work. The use of PBR is in this case subject to basically different conditions from the point of view of technology and work organization, in that the proportion of times during the work sequence which can be influenced by human work performance is considerably reduced. This applies not only to workers minding assembly robots but also, indirectly, to those at work stations integrated in the assembly line where the work to be done still consists mainly of manual operations: even at these work stations there is no possibility of increasing output beyond the production capacity of the assembly robots, since the rates of working are strictly synchronized.

In the field covered by the inquiry the combination of partly automated assembly lines and PBR is mainly of importance for the final assembly of an important product type at Plant B; but at Plant C, too, this form

of combination is encountered in the assembly of a sub-assembly for the same product type. In both plants the PBR system is partly in the form of piece-work with a fixed ceiling and partly in the form of premium wage (productivity premium) (for further details, see Section D below). In both cases the output-related wage component is subject to only very small fluctuations - wage payment displays strong tendencies towards a fixed wage system.

At Plant B, the importance of this form of combination has to be assessed against the background of a generally advanced level of mechanization and automation in many branches of production: many of the processes in the manufacture of plastic parts are fully automated; in the manufacture of metal parts and the assembly of sub-assemblies both conventional machines and individual robots are used; and individual production processes are partly automated (for further details see also Section E). Nowadays, manual operations predominate only in rectification work and pre-assembly work (mainly following the manufacture of plastic parts) and in part of the final assembly process.

In contrast to Plant A, where the work organization measures and the change in the principle of wage payment are part and parcel of the same management aims, at Plant B the automation measures in the assembly department that have been studied are being adopted independently of the existing wage payment system. This wage payment system is regarded by the plant representatives as being generally in need of revision, especially in view of the continuing trends towards automation.

2. Changes in production techniques and work organization in final assembly

The partial automation in the assembly lines studied is characterized by the combination of individual assembly robots and manual assembly work stations. In the assembly department (with a total of 200 workers) altogether four partly-automated assembly lines have been established on this principle, two of these being for one specific product type and two for another. These product types are appliances in large-scale series production. Depending on the product type, between 12 and 19 workers are employed on the partly automated lines.

Products which are only manufactured in medium-scale series production are assembled in traditional assembly lines involving predominantly manual operations. At the time of the inquiry there were three "manual" assembly lines in all (with 14-20 workers per line depending on the product type). These assembly lines are organized on the principle of division of labour, with the flow of materials based on production-line principles. The work stations are, however, separated by very large intermediate buffer areas (buffer capacity up to one week), so that there is actually individual working. (On the question of the connection between these manual assembly operations and wage payment principles, see Section D.)

Operations on the partly automated assembly line are characterized by close co-ordination of rates of working and extremely short work cycles. The average cycle time is three seconds. Despite the use of assembly robots, the majority of assembly operations are still manual.

The following assembly sequence may be regarded as an example of working on the partly automated assembly lines. Two robots are included in the assembly line. These together carry out seven out of the twenty or so assembly operations (plus automatic feed on to the belt). All the other assembly operations (including final inspection and finishing) are carried out manually; the "manual" work stations, at some of which several operations are carried out, are for the most part each manned by two workers, and in the final inspection and finishing area actually by four workers. A striking point is that only very simple connecting and testing operations (high-voltage testing) have been assigned to the automated work station. For instance, the first robot in the line studied performs the following operations: fixing together the motor and chassis, locking, intermediate high voltage test, and feed on to the belt. The second robot stamps the week number, closes the appliance and inserts the screws, screws in the screws, performs the final high voltage test and automatically feeds the units on to the belt.

The units are conveyed between the automated and manual work stations via a traditional conveyor belt. Between five and ten units can be buffer-stored between the manual work stations, which corresponds to a maximum buffer time of 0.5 minute.

All the tasks on the partly automated assembly lines, including the operations involved in minding the robots, have only a limited work content. The assembly tasks consist of carrying out simple connecting operations, while the testing tasks are simple visual and functional checks. The job of minding the robots consists mainly of loading, watching and remedying minor faults. The total job requirements are also slight: the manual

assembly operations and the testing and finishing tasks require training and familiarization periods of only 1-2 days, or at most 2-3 weeks (primarily final inspection). The requirements for the job of minding the robots are greater in that concentration, in particular, and also a certain amount of technical aptitude, are required. The training/familiarization periods are in this case 2-3 months.

It is notable that, in spite of the generally limited nature of the job requirements on the partly automated assembly lines, the workers employed on them are predominantly high-performance and younger workers, following a process of personnel selection within the plant (all the workers are female, the majority being in the 30-35 age group). The reason for this is that working on the partly automated assembly lines calls for a high degree of consistency of performance; since the rhythm of working has to be maintained, the stress imposed by the pace of the work is regarded by supervisory staff as being high in comparison with the manual assembly lines.

On the partly automated assembly lines, two further breaks of 10 minutes in the morning and 10 minutes in the afternoon have been introduced, in addition to the existing 20-minute mid-morning and 20-minute lunch-time breaks. In connection with this system of breaks it should be noted that the relevant framework collective agreement stipulates a rest time of at least five minutes per hour for those working under piecework and premium wage schemes. (The framework collective wage agreement also provides for an additional personal-needs time, akin to "personal delay times", of three minutes in the hour, which is generally included in the standard times.) At Plant B it is laid down under a plant agree-

ment that rest breaks provided for in the framework collective wage agreement can be taken individually by the workers. However, since it is difficult for the rest times to be taken individually on the partly automated assembly lines (this would entail at least the use of stand-by workers), the additional breaks in belt operation have been introduced. But this goes only half-way towards complying with the collectively agreed ruling.

3. Wage payment principles and methods

a. Differentiation of basic wages

Differentiation of basic wages at Plant B is based on analytical job evaluation.

The system of analytical job evaluation, which is based on the Geneva formula, contains 20 evaluation criteria. These are distributed as follows among the main categories of job requirement:

- ability: 2 evaluation criteria,
- responsibility: 3 evaluation criteria,
- stress: 3 evaluation criteria,
- environmental influences: 11 evaluation criteria.

Each evaluation criterion is given a weighting factor. The weighting factors are highest for the following evaluation criteria: knowledge, training and experience (1.0); stress on senses and nerves (0.9); and responsibility for the safety of others (0.9). The lowest weighting factors are in the main job requirement category of environmental influences (noise: 0.5; cumbersome protective clothing 0.1). Analytical job evaluation is based on the ranking method; up to 100 rank numbers can be allotted for each criterion. The work-

element values for each criterion are obtained by multiplying the rank numbers by the weighting factor. Lastly, the job evaluation category is obtained from the sum of the work element-values (divided by 10).

Under the system of analytical job evaluation used at Plant B the job values are combined to form 14 job evaluation categories. Up to job evaluation category 13 the point valuation in the rank figure allocation rises by five points at a time; from job evaluation category 13 upwards it goes up by 1.5 points at a time.

(The relevant framework collective wage agreement, on the other hand, provides for 12 job evaluation categories, the reference standard wage being that for category 6.)

The current system of analytical job evaluation at Plant B was introduced in 1967 and ratified in 1972 by a plant agreement (the works council was not set up until 1972, following the entry into force of the revised version of the Law on the Constitution of Businesses). In the application of analytical job evaluation at Plant B the following trend is generally observable: there is relatively little differentiation in the basic wages for simple semi-skilled jobs. The assembly workers in final assembly and those engaged in the assembly of sub-assemblies are nearly all in job evaluation categories 2 and 3 (the majority of them in category 2). A somewhat greater differentiation of basic wages is, however, observable in the case of jobs with more complex training requirements (robot operators, machine minders); these are mainly paid on the basis of job evaluation categories 4-6 (the majority of them in category 5). Both groups of workers consist almost entirely of employees paid according to a PBR system. By far the greatest differentiation

in basic wages, on the other hand, is to be found in the case of skilled jobs, which as a rule require specialized professional training, ie chiefly machine and robot toolsetters, repair and maintenance workers, toolmakers, etc. These groups of workers are for the most part paid on a flat-rate basis.

The limited nature of the job requirements on the partly automated assembly lines is also reflected in the evaluation of the jobs. The manual assembly jobs are all assigned to job evaluation category 2, and only the jobs of robot minding and final inspection are in category 3. According to the experts, the decisive factor for the higher evaluation of the jobs of minding robots are not so much the (slightly) higher qualification requirements as the greater concentration requirements and the "psychological" and "nervous" stresses due to the direct imposition of the work rhythm.

The differing evaluation of jobs on the partly automated assembly lines means that transfers are always made only within one job value category. Owing to the earnings guarantees provided under the collective wage agreements (the basic wage is always governed by the "permanent wage category", workers being mainly used at higher-value work stations on the basis of the higher job evaluation category), transfers between robot minding and manual assembly tasks on the partly automated line are as a rule avoided.

b. Wage payment principles

The characteristic feature of the situation at the plant is that the experts refer to the wage payment principles applied on the partly automated assembly lines (and also

in other areas of production) both as "piecework" and as "premium wage". This lack of uniformity in terminology is attributable to the fact that PBR at Plant B is based on the principles of piecework on standard time; since, however, a ceiling of 140% is imposed on the use of performance indices for wage calculation ("cut-off" piecework), the system of PBR displays some of the features of a premium wage (somewhat akin to a productivity premium with a proportional wage line). Another argument for treating the cut-off piecework system as a premium wage on the partly automated line is the fact that the scope for direct influencing of output by human work performance is limited in principle[1)].

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1) It must also be borne in mind that the relevant framework collective wage agreement contains an earnings guarantee for piecework: the "earnings (excluding collectively agreed supplements) achieved during the wage calculation period by all pieceworkers in the establishment must not ... from 1 November 1975 be less than 130% of the total of the establishment's piecework wages to be paid under the collective agreement". (Framework Collective Wage Agreement II in the Metal-Using Industries of North Württemberg/North Baden of 20 October 1973, Section 4.6.2.)

Most piecework wages or "premiums" in the plant are calculated individually. This also applies to the partly automated assembly lines[2]. A characteristic feature of the standardized PBR system is the narrow range of fluctuation of performance indices. On the partly automated assembly lines, for instance, the performance indices (around 137% at the time of the inquiry) only exhibited fluctuations with a spread of 2-3%, caused as a rule by trouble with the assembly robots.

c. Methods for determining standard times

The final fixing of standard times in Plant B is based on time recordings carried out in accordance with the principles of the REFA method. The actual time recording is, however, preceded by a very exact advance calculation of the standard times. This advance calculation is based essentially on empirical values expressed in the form of guide values specific to the plant. In more complex situations use is also made of MTM synthetic values (basic method). According to the experts, the degree of approximation of the times calculated in advance to the final standard times (based on time recording) is ± 3%.

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2) This practice in the application of wage payment principles must be seen against the background of, among other things, the provisions of the relevant framework collective wage agreement: the introduction of group piecework presupposes the existence within the establishment of a system of group working as defined by the collective agreement (specifically: size of groups, reference parameters for permissible workload of the group, rules concerning overmanning and undermanning, etc). See in this connection Framework Collective Wage Agreement for the Metal-Using Industries of North Württemberg/North Baden, Section 3.13.

4. Influence of the works council and the trade union

On the whole, according to statements by the plant experts and also by the works council, it can be assumed that the application of wage payment principles and methods for determining the output-related wage component is not a subject which gives rise to any conflict in the system of industrial relations system at the plant. As a rule the works council is not present when time recordings are being made; only in the event of complaints by workers about timings does the works council intercede in the determination of standard times. According to the works council, however, timing complaints are very rare and are usually settled by "amicable agreement".

Under the plant agreement of 1972, the works council is in principle involved in the evaluation of jobs by the analytical method; the evaluation is made by a committee composed of equal numbers of members of the works council and the plant management. The committee has jointly worked out evaluation guidelines. These are based on the guiding examples for evaluation contained in the annex to the relevant framework collective wage agreement; these guiding examples are illustrated, in a published list, by empirical values recorded in companies.

According to the plant experts the joint committee was manned, on the management side, by representatives of the "inner circle of management" - the chairman of the works council and the personnel manager participated in the committee's negotiations with the status of "observers". In order to remove the element of confrontation from the discussions concerning the assignment of individual job values and prevent them from being

as "internal collective negotiations", the plant management side replaced the members of the "inner circle of management" by specialists from the departments involved (work preparation, production management, personnel department) - this shifting of the negotiations to a "lower plane" having been designed, as stated, to remove the element of confrontation and create the possibility of "co-operation as a single body".

According to both the works council and the management representatives, open conflicts are avoided - even disputed points are debated until agreement is reached. The evaluation of semi-skilled jobs in final assembly and the assembly of sub-assemblies does not generally engender much contention; differences of opinion arise more with regard to skilled jobs, especially in connection with evaluation criteria relating to knowledge and experience requirements, and also responsibility.

5. Company motives, effects and problems associated with the technical and organizational changes and the existing wage payment system

a. Motives

(1) Development of production technology and work organization. The advanced state of production technology in Plant B is the outcome of a process of gradual technological and organizational rationalization which has been promoted for decades. This development has been greatly assisted by the homogeneous structure of the product range and a very stable market situation with growing market shares: only one product is manufactured, in a limited number of models, but with a large number of variants mainly imposed by export requirements (although the variants, 105 in all, for the most part display only minor deviations from the basic models); the work is

predominantly mass production.

Despite a slight increase in fluctuations in demand (partly due to the changed buying behaviour of dealers, who wish to keep their stocks low), the market does not at present impose any significant requirements for flexibility in the arrangement of technical and organizational production structures, work organization and utilization of labour; in the past, when large backlogs of orders have overtaxed capacity, the resultant flexibility problems have been solved relatively easily by transferring individual stages of production to other plants in the group (mainly Plant C) or to suppliers outside the group.

Changes in products and series are also made easier in Plant B by the uniform technical construction of the products (this has undergone hardly any significant change in its basic structure during the last 25 years or so). According to the plant experts the opportunities for "time-saving" rationalization by levelling out cycle times in the work processes and co-ordinating the individual stages of production with each other have been practically exhausted.

Owing to the far-reaching standardization and rationalization, there now remains only very limited scope for mobilizing workers' performance reserves through work-organization measures. The strategy of technological and organizational rationalization pursued in Plant B is mainly characterized by ad hoc recourse to technical solutions with a view to further increases in productivity. Automation measures are adopted in cases where possibilities exist for real technical rationalization giving a relatively quick

return on investment. One clear example of this strategy is seen in the technical and organizational layout of the partly automated assembly lines. According to the experts, it would in principle be perfectly possible to automate all the work stations on these assembly lines. The investment costs entailed would, however, be so high that such a step would not produce any rationalization effect at present. Firstly, for instance, difficulty is still being experienced in transferring oblique connecting operations to automated work stations; secondly, robots used in interlinked work sequences have to meet rigorous demands as regards trouble-free operation. (The assembly robots have been developed by the plant itself, but are based on known examples in the industry.)

(2) Wage payment

a. The use of analytical job evaluation in Plant B has to be viewed in close relation with the strategies of rationalization and progressive automation of production processes. The aim is to achieve a more marked differentiation of basic wages which is "more consistent with job requirements" specifically for those categories of workers whose importance increases with advancing mechanization and automation: firstly, operators and minders of robots and, secondly, toolsetters, maintenance men and skilled workers engaged in jig- and toolmaking, the most important differentiation from the company's point of view being that between different "skilled jobs" (toolfitters and skilled minding and operating jobs on robots (cf Type IV).

b. According to the plant's experts the purpose of imposing a ceiling on piecework earnings was originally to prevent excessively fast pieceworking and the result-

ant "method drift"; it is also observable, however, that it had the effect of adjusting wage payment principles to progressive automation. Specifically, there is the fact that on the partly automated assembly line there remains only limited scope for the influencing of output by human performance; at the assembly robots the work rhythm is imposed directly, and this means that is imposed indirectly at the manual assembly work stations. There is, however, the possibility of losses in output due to minor stoppages at the robots and/or hold-ups in the assembly process which do lie within the sphere of influence of human performance. Consequently, the main function of the PBR principle in these cases is to create an incentive for workers to prevent or quickly remedy stoppages and temporary hold-ups. Secondly, the "cut-off piecework" system corresponds to the upper limit that is imposed on output by the production technique. Nevertheless the plant management wonders whether an alternative wage payment principle would not permit a fairer adjustment of incentive payments to the strategy of ad hoc automation. From the plant's point of view the most likely solution appears to lie in the principles of a premium wage. In the management's opinion, however, only one form of premium wage is suitable for this, namely that where, as with piecework, the quantitative production performance (output) is the reference quantity for the performance-related wage component (productivity premium). The introduction of premiums for the use of machines would create considerable data-collection problems. A quality premium would run up against virtually insoluble allocation problems, since in most areas of production the quality of components and sub-assemblies is felt to be influenceable more and more by the material and machines and less and less by human work performance.

c. Although standard times are being determined, as formerly, on the basis of the REFA method, there has in fact been a shift in the direction of precise advance calculation, which is carried out partly with the aid of the plant's own guide values (based on REFA synthetic values) and partly by the use of MTM. This development is an integral part of the strategy of successive advances in rationalization and automation in production processes whose structures are very stable: owing to the stable product structures and the long-running series, major new time recordings are relatively rare. The plant management is therefore interested in methods of determining standard times whereby continuous minor changes which occur frequently in the everyday operation of the plant can also be quickly and easily taken into account. Although from this point of view the introduction of systems involving predetermined times would suggest itself for the final fixing of standard times, no effort is being made to introduce a general change in the method of time determination. The main reasons for this are as follows:

- In the plant management's opinion the existing method adequately meets the requirements for a "rational" determination of standard times.

- The use of systems involving predetermined times requires a lengthy period of preliminary work in order to adjust the corresponding synthetic values to the conditions of the plant in question.

- The introduction of systems involving predetermined times requires, in Plant B's wage-scale district, the prior consent of the parties to the collective agreement; hence the conclusion of a plant agreement

with co-option (consultation) of the parties to the collective agreement is not sufficient. The consent of the competent district administration of the Metal-Using Industries Trade Union would undoubtedly only be given in return for substantial concessions by plant management in fixing the correction factor to be applied in relation to the REFA times.

b. Effects and problems of linking partial automation with PBR

The plant has obtained considerable increases in productivity through the strategy of ad hoc automation. According to estimates made by the plant's experts, the product throughput time in the partly automated assembly line has been approximately halved compared with the previous "manual" assembly processes (with the same number of workers).

On the other hand, the linking of assembly robots with manual assembly operations has led to very short working cycles and functions whose tempo is both directly and indirectly governed by the machines. This also increases the stresses and restrictions experienced by the workers, especially in the functions involved in minding the assembly robots (concentration and attentiveness).

The plant management and the works council are fully aware of this problem but, given the production structure, cannot see how any significant improvements can be made. Although the increased stresses on the workers and the higher performance requirements are not thought likely to cause any problems in personnel utilization at the moment, from the longer-term point of view there is the problem of how the plant is going to use lower-performing and older workers. At present a large propor-

tion of its permanent work-force consists of workers in fairly young and middle age groups.

Although the "cut-off" piecework system (or a productivity premium with a proportional wage line) meets the company's requirements as regards incentive payment on the partly automated assembly lines (or comparable manufacturing processes), its application as a uniform wage payment principle to all areas of production creates problems: as has been mentioned, there are still also some traditional assembly lines involving predominantly manual assembly operations, in addition to the partly automated lines; the "cut-off" piecework system also restricts the scope for maximum mobilization of performance and rationalization reserves. Furthermore, there is the question of what purpose a "cut-off" piecework system serves for simple operating and minding jobs in highly automated manufacturing processes where the proportion of influenceable times tends towards zero.

The plant management is aiming to convert the existing piecework system into a "genuine" premium wage in the highly automated and partly automated production processes, but its efforts have so far failed, largely owing to the plant's as yet inadequate data-collecting systems. It should also be borne in mind that the relevant framework collective agreement lays down very stringent requirements as regards data collection for premium wages as well as for other payment systems.

D. Individual working and tendencies towards fixed wages - Type III (Plant C)

1. The importance of Type III within the field covered by the inquiry

The characteristic feature of the combination of work organization and wage payment analysed in Type III is the linking of traditional forms of individual working with a "frozen" piecework rate. In terms of work organization this combination displays similarities with Type I, since individual work performance is predominant in this case too. In the application of wage payment principles, on the other hand, there are marked similarities with Type II. In contrast to Type I, the purpose of PBR in this case is not to mobilize performance reserves; the purpose of the frozen piecework system is to achieve the greatest possible uniformity in the workers' performance and earning levels.

Within the scope of the inquiry this combination between work organization and wage payment was encountered primarily in the assembly of sub-assemblies at Plant C, and reflects the plant's interest in the highest possible degree of flexibility and responsiveness in production processes and labour utilization.

Unlike other plants, Plant C does not produce directly for the market but is a "supplier" of components and sub-assemblies for the product ranges of the other plants. This leads to a high degree of differentiation among the semi-manufactures produced (metal parts, individual sub-assemblies) and a high degree of dependence on demand and also on product and production plans for the other plants. Compared with the position in the other plants, at Plant C the assembly of sub-assemblies

is of limited importance in relation to overall production: the other areas of production (die-casting, metal-working, metal-cutting, surface treatment) only in some cases precede the assembly of sub-assemblies within the plant (24% of the manual workers are engaged in assembly work). A characteristic feature of the plant generally is a comparatively high level of mechanization and automation in the production processes of die-casting, metal-working, metal-cutting and surface treatment; in the assembly department the work mainly consists of manual operations, despite the partial automation of individual assembly processes.

The management endeavours to make allowance for the different levels of development of production technology by making use of several wage payment principles (piecework, premium wage and flat rate): premium wage is used only if the jobs contain less than 30% of influenceable times; apart from that, manual workers in production are paid at piecework rates (flat rate is used for inspectors, toolsetters and workshop assistants).

2. Technical and work-organization structures in the assembly of sub-assemblies

The characteristic feature of the manual assembly jobs involved in the assembly of sub-assemblies is that self-contained work processes are performed at traditional individual work stations.

The workers engaged in assembling sub-assemblies number about 120, most of them migrant workers. They are all female, the majority being in the 20-35 age group. There is double-shift working in this assembly department; the workers have two breaks of 15 and 30 minutes

respectively.

In the assembly process chosen for the inquiry, a sub-assembly is made for a product of product family a (Plant B). Four to five different operations are carried out at each of the individual work stations. The use of individual work station in this assembly process is not the result of any change in work organization (such as the abandonment of production-line working); in the past such changes as have been introduced in the plant have related only to workplace design and the design of the work process.

Formerly, all the individual operations on a given workpiece were carried out at individual benches. Now the parts are fed to the work stations on a circular tray; this means that each individual operation can now be carried out separately on 50 workpieces in succession. The aim was to save time by the separate sequence of the individual operations, but in the opinion of the foremen this aim has not been achieved. The average cycle time for the performance of individual operations on the circular tray (50 parts) is about 1.3 minutes.

Despite the comparatively complex nature of the assembly tasks, the qualification demands made on the workers are slight in this work process too; no special knowledge or skills are required. While the workers are as a rule permanently assigned to their work stations, they must in principle be able and willing to perform a variety of tasks (all the workers are trained for three to four work stations). There is considerable pressure for interchangeability, since the ranges of parts manufactured to supply the other plants change frequently and fluctuations in the volume of production required in each case have to be absorbed.

3. Wage payment principles and methods

a. Differentiation of basic wages

At Plant C, again, the differentiation of basic wages is based on analytical job evaluation. Although analytical job evaluation is carried out here according to a different system from that applied in Plant B's wage-scale district, the divergences are only slight. (For fuller details on the introduction of analytical job evaluation, see Section 4.)

The evaluation criteria, which here again are assigned to the main job requirement categories according to the Geneva formula, hardly differ at all from those used at Plant B (exception: for stress, the system used at Plant C has only two evaluation criteria). The main difference between the systems of analytical job evaluation employed at Plants B and C lies in the method of evaluation: at Plant C the evaluation is carried out according to the highest point rating method. The highest point rating for each evaluation criterion is limited to 9 points. The highest point ratings are in the job requirement categories "ability" (job experience: 9 points), "work stress" (mental stress: total of 8 points) and "responsibility" (responsibility for plant equipment and products: 7 points). The lowest point ratings are for the individual criteria in the main job requirement category "environmental influences", but this is the category with the largest number of evaluation criteria (total 11) (noise: 2.5 points, dazzling or insufficient light: 1 point).

As at Plant B, here too the job values are grouped into job evaluation categories. In the analytical job evaluation method applied at Plant C there are 12 job

evaluation categories in all, but only categories 3 to 11 are actually used (by way of comparison it may be mentioned that the wage category system under the relevant framework collective agreement contains 9 wage categories)[1].

Compared with the wage category system under the relevant framework collective agreement, the use of analytical job evaluation permits, in particular, a greater degree of differentiation of semi-skilled jobs on the basis of differing qualification requirements and stresses. This results in a considerable degree of overlapping between the evaluation of semi-skilled jobs (especially in die-casting, metal-cutting and metal-working) and skilled jobs (eg toolsetters). A striking point is that the application of analytical job evaluation to assembly work results in very little differentiation, the great majority of jobs falling into category 3. Likewise in the assembly of sub-assemblies at individual work stations that was studied in the inquiry, all the jobs are assigned to category 3.

Irrespective of the wage payment principles (piecework, premium wage and flat rate) the plant's wage structure provides for increments on top of the basic wage (or standard piecework rate), some of which are eligible for inclusion in collectively agreed rates and some not.

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1) The composition of the job value categories does not conform to the wage system of the individual framework collective agreement concerned. Whereas in the framework collective agreement the reference standard wage is wage category 6, the reference wage lies between job evaluation categories 6 and 7 in this system of analytical job evaluation.

There is a voluntary eligible supplement of 8% and a voluntary non-eligible supplement which is expressed in fixed sums of money. The non-eligible voluntary supplement enables the plant to achieve an additional wage differentiation, since these supplements do not conform to the differentiation of basic wages laid down in the scale of job evaluation categories. (For instance, the jump in the voluntary non-eligible supplement is DM 0.05/hour between job evaluation categories 3 and 4, DM 0.15/hour between categories 6 and 7 and DM 0.10/hour between categories 7 and 8, returning to DM 0.05/hour per category from category 8 upwards.)

b. Wage payment principles

In the assembly of sub-assemblies the traditional system of piecework on standard time is the predominant wage payment principle. Premium wage is paid only in the few partly automated assembly processes where the proportion of influenceable times has fallen below 30%.

The standard piecework rate in Plant C's wage-scale district is 103.5% of the basic flat rate under the collective agreement; it is thus, for instance, well below the standard piecework rate in Plant A's wage-scale district (110%). However, the plant makes a supplementary payment of 8% on top of the agreed standard piecework rate. While piecework is in theory "free", an informal limit of 135% is imposed on payment based on performance indices.

In assembly, piecework earnings have settled down at the level of an average performance index of about 133%. Despite formally "free" individual piecework, the performance index is also actually subject to a lower limit; if workers fall below the target performance of 130% they are transferred to other work stations or deemed "unsuitable" for the job. Keeping watch on the observance of the upper and lower limits of the performance indices paid for is an important task for the foremen.

c. Method of determining standard times

Standard times are generally determined in the plant by the REFA method. As in Plant B, the times are calculated in advance on the basis of internal guide values which are recorded and kept up to date in a publicly displayed schedule of planning times ("Planzeiten-Katalog").

4. Influence of the works council and the trade union

On the whole the works council regards the workplace-design measures adopted at the individual work stations in the assembly of sub-assemblies, in which MTM principles were applied, as representing adequate observance of existing knowledge in the field of work science. It therefore saw no grounds in Plant C, either, for exercising its corrective right of co-determination under Article 91 of the Law on the Constitution of Businesses.

The works council and representatives of the local district administration of the Metal-Using Industries Trade Union participated in the introduction of analytical job evaluation at Plant C and exerted a strong influence on the choice of method; it was introduced at the factory

by a plant agreement concluded in 1974. Since the framework collective agreement applying to the factory does not contain any basic principles for analytical job evaluation, the choice as to what system was to be employed was an open one. The company (or group) proposed taking over a system from a wage-scale district which is very strongly geared to the specific conditions of the steel industry and in which the main emphasis is on environmental stresses. Since such environmental stresses do not occur to the same extent in Plant C, the works council and the trade union representatives feared the possibility of demotions to lower categories and rejected the company's proposal. They therefore pressed for a system of analytical job evaluation from another wage-scale district which is designed more for manufacturing industry, and this was accepted by the company.

The eligible supplement of 8% (see above) was negotiated in connection with the introduction of analytical job evaluation.

The works council is on the whole in favour of the principles of PBR. It regards piecework, in particular, as the fairest wage payment principle, since it allows "everyone to be paid according to his performance" and the workers have some control over the relation between performance and wages. The works council at Plant C does, however, acknowledge that with free individual piecework there is a danger of workers trying to do too much and a danger that standard times will be reviewed in the light of excessively high performance indices. To this extent it welcomes the informal limitation of performance indices. The works council itself is endeavouring to exert an influence

on the limitation of the performance indices paid for, through informal contacts with the foremen.

The works council is not as a rule present when time recordings are carried out. It considers that its absence helps to remove the element of confrontation in the event of complaints by the workers about standard times, as the works council cannot then be regarded as being partly responsible for the times fixed. It is also emphasized that continuous participation by the works council in time recordings would take up more time than can be spared.

According to representatives of both the works council and the production planning department, the fixing of standard times is generally not to be regarded as a controversial area. Complaints about timings are the exception rather than the rule and only rarely lead to corrections in timings.

5. Company motives, effects and problems associated with the combination of individual working and frozen piecework at Plant C

a. Motives

1. Work organization. As has been mentioned, Plant C's position as a "supplier" to the other plants means that very rigorous demands are made on it for flexibility and responsiveness of production. These requirements are made even more stringent by the fact that Plant C's production capacity is also used as a buffer in the event of bottlenecks at the other plants.

In the assembly of sub-assemblies the plant tries to meet these requirements by applying the work-organization

principle of individual working. Other forms of work organization - such as production-line working - would impose a more constant level of production and would hamper the responsiveness in terms of labour utilization that is required of the plant. The individual work stations allow a high degree of flexibility in the utilization of labour. Depending on production requirements, the existing work stations can be either fully utilized or only partly manned. At the same time, this means that interchangeability is essential.

2. Wage payment. Theoretically, this principle of work organization should allow the "freeing" of performance and individual piecework earnings more than any other. The primary reason for the "informal limitation of payment based on performance indices" in this case is the required flexibility of labour utilization: uniform average performance at all work stations is intended to aid interchangeability. On the one hand, problems of fair wages ("good" and "bad" work stations) and resultant conflicts should be avoided; on the other hand, despite the need for flexible labour utilization it should be possible to plan for and ensure steady output. The limitation of piecework earnings at individual work stations is therefore in the direct interest of the management.

A further reason for the informal limitation of piecework earnings is the company's interest in maintaining the stability of the existing wage structure. In the other areas of production in the plant the limitation on actual earnings comes mainly from the limitation imposed by the actual production techniques on the times which can be influenced by human work performance. Above-average levels of earnings in the assembly of sub-assemblies would create a danger of demands for wage

Altogether, 13 workers are employed in this stage of production. They comprise three toolfitters and ten machine-minders, each of the latter being responsible for two or three automatic machines. Working is in three shifts. The machine-minders are all semi-skilled workers. The training period is about four weeks; but the workers chosen for these jobs are ones who already have experience of machine-minding in other stages of production in the plant.

(2) The equipping of printed circuit boards is done in highly automated lines operating on the principle of transfer assembly systems. Four printed circuit board lines for different types are in use. The lines contain 15 or 16 automated work stations. The tasks to be performed in these printed circuit board lines are mainly supervising functions, although minor interventions in the systems are also required, such as adjustments at the welding stations and the remedying of minor faults causing stoppages. (The line is followed by manual rectification work stations, particularly for remedying soldering faults.) According to the plant experts the main requirements are care, dexterity and technical understanding. In addition to the workers responsible for supervising and minding, one toolfitter is employed on every shift. In this stage of production also, semi-skilled workers are used for supervising and minding the transfer systems, but they must have the initial qualification of having received vocational training "outside the industry". These are mainly younger workers aged between 25 and 35 (maximum age about 40).

It should be noted that, both on the automatic coil winding machines and on the printed circuit board lines, human work performance does, within certain limits, exert an influence on the course of production and output.

Although the actual process time cannot be influenced, the total throughput time for a certain production volume can be shortened by prompt detection of faults and quick remedying of stoppages.

b. Automation in the assembly of sub-assemblies at Plant A

Unlike the automation of the assembly of sub-assemblies at Plant B, the selected automated process at Plant A involves the assembly of a sub-assembly capable of independent operation which passes direct to the final assembly stage (electric motors).

On the principle of transfer assembly systems, assembly takes place "on line" at a number of automated work stations. To enable the automated assembly process to respond flexibly to technical faults, a number of automatically operating rectifying systems are included in the line. Nevertheless, there are at the end of the assembly line two "off-line" work stations (testing and balancing) where two workers are assigned to mind the machines; it would be possible, from the technical point of view, to include these work stations in the automated assembly process, but this would entail substantial capital investment. The same applies to the feeding of the transfer system, which is done manually.

Two transfer assembly systems are in use, for the manufacture of different types of motors.

The supervising, inspection and fault-remedying functions in this transfer system are designed solely to ensure a continuous production flow. There is no need for any direct interventions in the automated assembly process. Such faults as occur are mainly due to faults in the

technical functioning of the automated work stations; they can only be remedied by interventions in the technical function mechanisms of the stations which as a rule call for specialized technical knowledge and skills.

Two skilled workers (electronic engineer and mechanic) are employed on each shift to supervise the transfer systems and deal with breakdowns. The feeding and minding functions preceding and following the transfer systems are performed by semi-skilled workers (five per shift). Here again there is three-shift working.

c. Automation in parts manufacture at Plants C, B and A

A common feature of the selected highly automated processes in parts manufacture at Plants C, B and A is that the systems in question consist of non-linked individual automatic machines not requiring any intervention in the production process. Such hold-ups as occur are as a rule due to technical operating faults. Manual interventions in the production process are confined to operations performed before and after the automated process. Examples of the processes discussed here are automatic lathes at Plant C and automatic plastic-injection-moulding machines at Plants B and A.

(1) In addition to conventional lathes, use is made at Plant C of automatic lathes (six altogether) for turning operations involving very large numbers of units. The tasks to be performed on these automatic machines consist only of fixing the workpiece in the chuck, starting the machine, watching the turning process, callipering (measuring) the processed workpieces and taking them out of the chuck. The workers do not have to rectify any faults

on these automatic machines themselves; their function is confined to promptly recording any faults which occur and reporting them to the toolsetters.

Only semi-skilled workers are used for minding and supervising the automatic machines. The training takes about six weeks; some of the workers are trained on the spot and others are taken over from other parts of the plant. Each of the workers is responsible for one automatic machine. They work a single shift. If faults occur and it takes a fairly long time to remedy them, the workers are transferred to other jobs.

(2) The manufacture of plastic parts is fully automated both at Plant B and at Plant A. The automatic plastic injection-moulding machines used here (thermoplastic method) mainly make small and medium-sized plastic parts. There are 70 automatic plastic injection-moulding machines in use at Plant B, and 40 at Plant A.

The tasks of minding and supervising the automatic machines are for the most part confined to removing the plastic parts and supervising the production process. The feed is automated; if any rectification of the parts is required, this is done at separate work stations. Apart from setting-up functions and the remedying of technical operating faults, which are done by workers specifically assigned to these tasks, no interventions in the production process are required (for instance, it is not even necessary to spray or clean the workpieces after the injection-moulding process).

There is as a rule multiple machine minding: on average one worker minds two or three machines, and where more simple parts are being made one worker can be responsible for up to six machines (eg Plant B).

Semi-skilled workers are generally used to mind and supervise the automatic plastic injection-moulding machines; no special knowledge or skills are required.

As already mentioned, the setting-up work on both the automatic lathes and the automatic plastic injection-moulding machines is done by workers specially responsible for this (toolsetters); these are as a rule trained skilled workers (at Plant B many automatic machines have to be set up afresh as many as eight times per shift). In plastics manufacture there is three-shift working in both plants, and there are toolsetters working on each shift. They are also responsible for remedying faults.

3. Differentiation of basic wages and wage payment principles[1)]

From the point of view of the questions we are studying particular importance attaches to the fact that, in the automated assembly and manufacturing processes and forms of labour utilization described here, use is made of a variety of wage payment principles which either formally or in their practical implementation exhibit characteristics of fixed wages. More specifically:

a. Assembly of sub-assemblies at Plant B

The machine minders and supervisors working on the automatic coil-winding machines and on the printed circuit board lines are paid a so-called "premium wage", although this (as has been explained in detail) should be regarded

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1) For the methods of wage payment - methods of differentiation of basic wages, determination of standard times - see the separate discussion of these points in the preceding sections.

as no more than another term for a cut-off piecework rate; but there are only slight fluctuations in the performance indices achieved. Toolsetters, on the other hand, are paid a flat rate, but there is a performance bonus which is worked out on the basis of (annual) analytical performance evaluation.

The machine minders and supervisors on the automatic coil-winding machines are classified in job evaluation category 5, and those on the printed circuit board lines in category 6. According to the experts, the reason for this difference in the basic wages lies in the higher requirements for concentration and technical understanding and also the greater responsibility involved in these jobs on the printed circuit board line. Toolsetters are classified in job evaluation category 11 in both of these production stages.

b. Assembly of sub-assemblies at Plant A

The skilled workers employed in the transfer assembly system at Plant A are paid a flat rate; there are no additional performance bonuses. On the other hand, the workers who perform manual operating and feed functions preceding and following the transfer system are paid on a standardized piecework basis. The skilled workers are in wage category 9 and the manual "operators" in wage category 5 of the relevant framework collective agreement (semi-skilled workers in stress category II).

c. Parts manufacture at Plants C, B and A

(1) The workers employed on the automatic lathes are paid on a premium wage basis. The premium applied in

Plant C is in the form of a productivity premium[1]. As described earlier, premiums are generally applied in the plant if the production process contains less than 30% of influenceable times. The performance-related wage component under the premium system is generally limited to 30%. The premium function line is proportional. The premium reference time (100%) is fixed at 45 minutes, so that in an actual hour worked there is a performance-related portion of 30%.

The workers on the automatic lathes are classified in job evaluation category 6; according to the plant experts the main reason for this is the "greater responsibility" (workers on conventional lathes are classified in category 5).

(2) For jobs on the automatic plastic injection-moulding machines a flat rate (plus dirty-work and shift bonuses) is used at Plant A, while at Plant B the so-called premium wage (ie a cut-off piecework rate) is paid. At both plants the toolsetters are paid at a flat rate. While toolsetters at Plants B and C receive in addition a performance bonus based on analytical job evaluation, at Plant A workers paid at a flat rate do not in principle receive any performance bonuses.

The machine-minding jobs on the automatic plastic injection-moulding machines are classified in wage category 5 at Plant A and in job evaluation category 4 at Plant B.

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1) Whenever a change-over is made from piecework to premium wage, a premium agreement has to be concluded in which the initial premium payment, the maximum premium payment and the premium function line are laid down for the individual case.

4. Company motives, effects and problems associated with the various forms of combination of automation and wage payment principles[1)]

a. Motives

(1) Automation of assembly and manufacturing processes. The advanced state of automation in manufacturing processes and the growing importance of the automation of production processes in the assembly of sub-assemblies show that the cases where plants are best able to obtain increases in productivity as a direct result of introducing more advanced technology are those where it is possible to combine standard components and sub-assemblies (which are to be incorporated into a number of different products) so as to form very large series. This presupposes that, where the market demands a large number of variants, the end products are constructed on the modular principle using sub-assemblies and components which are as far as possible identical; the multiplicity of variants in the end products can then largely be achieved (apart from making models in different colours) by adding or omitting certain components and sub-assemblies. Another example of this is the technically more or less identical construction of the different variants of electric shavers at Plant B or individual kitchen appliances at Plant A.

2. Wage payment principles. None of the three plants has developed a specific wage payment system designed

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1) The aspect headed "Influence of the works council and the trade union" that was included in the discussion of the other types can be omitted here since, as far as the questions we are considering are concerned, at the individual plants there are no notable deviations from the forms of works-council and trade-union influence which have already been described.

for the use of human labour in automated production processes. In all cases wage payment principles which have evolved in the plants in connection with other production structures are taken over and adapted to the specific conditions and requirements of work in highly automated manufacturing and assembly processes. This has confronted the plants with the fundamental problem of whether and to what extent PBR principles can or should be retained at all for jobs of this kind. In their attempts to solve this problem the individual plants have adopted various different approaches which to a great extent bear the stamp of the wage payment systems originally designed for the plants in question and of the general policy pursued by the plant. More specifically:

- In the case of the automatic coil-winding machines and the printed circuit board lines at Plant B the premium wage applied corresponds to the principle of "cut-off" piecework which predominates in the plant as a whole. In the view of the plant management the main purpose of the wage incentive in jobs on the automatic coil-winding machines and printed circuit board lines is to ensure that hold-ups in the process are promptly detected and remedied as quickly as possible.

- The use of a flat rate for supervisory, fault-clearing and repair work in the transfer assembly systems for motor assembly at Plant A follows the plant's general practice as regards the payment of skilled workers. In the opinion of the plant management it is fundamentally questionable in the case of such jobs whether the required work performance and attitudes (especially reliability, sense of responsibility, regular attendance, etc)

can be influenced at all by the wage incentive instrument. A more appropriate course, in the management's view, is an extension and intensification of training, such as a higher degree of training for mechanics based on the qualifications required of skilled workers. As far as financial incentives are concerned, the management is thinking in terms of premiums, but in this case primarily ones based on quality of production and use of machines. A second possible course is thought to be the raising of basic wages with a view to attracting skilled and reliable workers for such jobs. On the other hand, the application of the standardized piecework system to the manual feeding and minding tasks preceding and following the automated systems corresponds to the traditional method of payment for semi-skilled workers at Plant A, which was also predominant throughout the assembly department until the "freeing of piecework".

- The payment of a premium wage to workers on the automatic lathes at Plant C corresponds to the general principles adopted on the introduction of the premium wage system in the plant (less than 30% influenceable times). However, the plant management feels that the use of the premium wage system for such jobs is no longer appropriate to the functions concerned, since this wage now operates only as an "attendance premium" (the time spent on fixing the workpieces in the chuck is relatively short). Conversion of the premium wage into a flat rate is not considered possible at the moment, since it would lead to substantial losses in earnings for the workers.

- The application of the so-called premium system (in principle a cut-off piecework rate) to the workers on the automatic plastic injection-moulding machines at Plant B again corresponds to the predominant wage payment principle. However, the plant experts consider that its application to these jobs is no longer functionally appropriate to the functions concerned, since there is no longer any way at all in which the worker can influence output and the premium is here again actually no more than an "attendance premium". The management is therefore contemplating introducing a flat rate (as at Plant A) for workers on these automatic machines, but one combined with performance bonuses based on analytical performance valuation.

  In all the plants it is apparent that, with the progressive automation of manufacturing and assembly processes, toolsetters are increasingly coming to occupy a key position. This also explains the interest on the part of management in also applying to these jobs, for which the workers as a rule receive a flat rate, certain PBR principles. The combination of a flat rate with performance bonuses based on analytical performance evaluation is the system most widely regarded - and applied - as the instrument for doing this (Plants B and C).

b. Effects and problems

(1) In principle, the automation of the assembly of sub-assemblies opens up new possibilities of substantial gains in productivity for the plants. For instance, the estimated saving in personnel for motor assembly at Plant A achieved by the use of transfer assembly systems is about 30-40 workers; the cost saving per product unit

is estimated by the plant management at about DM 10.

In parts manufacture, on the other hand, a high degree of mechanization and automation has already been achieved during the past few years, so that no great further scope remains for the achievement of gains in productivity by improved technology. According to the plant experts the possibilities in this direction have already been largely exploited. (But this does not mean that all the technical possibilities for further automation are exhausted.)

(2) With advancing automation, an already familiar problem connected with the application of PBR principles is becoming more acute. Automation has the effect of gradually reducing the influencable times; but there are fundamental difficulties in making allowance for this development in all plants in the application of wage payment principles.

Because the result-related wage component often, for various reasons, becomes a rigid amount even in those areas of production where the production result can be influenced to a relatively large extent by human performance, it becomes a fixed element of the plant-wide wage structure and serves as a reference point for the workers' expectations regarding earnings. This creates rigidities in the plant's internal wage structure which fundamentally impede the change-over from established PBR principles (standardized piecework, premium wage) to flat rates or a combination of flat rates and performance bonuses. Adjustment of the result-related wage component to the possibilities of influencing the production result which still actually remain, or its total abolition, would in most cases lead to considerable losses in earnings (of up to about 30%); and even

performance bonuses based on analytical performance evaluation are not sufficient to offset the existing difference between basic wages and actual earnings under PBR systems. This is also why the company experts are of the opinion that the result-related wage component is basically too high. In this situation there is the additional possibility of an increase in the pressure to change wage payment principles and methods or their practical implementation in those areas of assembly and manufacture with a relatively high proportion of influenceable times, in order to bring about an overall reduction in the result-related wage component. Lastly, the problem is also made more acute by the fact that under the existing methods of basic wage differentiation - especially analytical job evaluation - it is not possible to compensate for a reduction in fixed "result-related" wage components simply by means of a job-related increase in basic wages or the payment of special supplements.

IV. General problems and effects of the relations between production techniques, work organization and wage payment - Summary

It is obvious that since our case analyses were few in number and, furthermore, related only to selected stages of production at plants within one group of companies, it is not possible to draw any general conclusions regarding trends in wage payment systems, and in particular the development possibilities and limits for PBR in the German electrical engineering industry. Nor was it the intention to draw such conclusions from this study. Rather, as was explained more fully at the beginning, we concentrated on

identifying the influence of various plant conditions on individual combinations of production techniques, work organization and wage payment and on showing the interests of management in the existence or alteration of such combinations. In the course of this analysis, however, a number of problems and effects emerged whose importance is more general and extends beyond the individual case. These are associated firstly with the interrelation between the wage and performance policies applied in the individual plants on the one hand and, on the other, the aims of increasing efficiency and productivity which are pursued through changes in work organization and the development of new production techniques (1). Furthermore, however, these problems and effects also concern the work situation of the workers in question (2); and lastly, industrial relations within the plant do not escape them entirely (3).

1. Problems and effects for the company

a. General findings

Firstly, note should be taken of certain general findings emerging from the case analyses which are, at first sight, fully in accordance with the trends outlined in Chapter I:

- On the whole the production processes in the plants studied are characterized partly by a large measure of organizational rationalization and standardization and partly by an advanced stage of mechanization, partial automation and full automation. In assembly processes still involving a sizeable proportion of manual assembly operations there is a definite interest for the company in replacing production-line

working by flexible work organization structures; however, the work-organization measures applied - decoupling of production-line work stations, retention of the traditional forms of individual working - are in no way spectacular, nor do they lead to any systematic elimination of repetitive sub-operations. (It should not be overlooked that in some assembly lines partial automation, if anything, actually tends to aggravate the restrictiveness of the work situation for the workers concerned because of the limited work content and the strict adherence to the working tempo that it imposes.)

- Wage payment in the field covered by the inquiry is mainly based on traditional PBR principles. The predominant wage payment principle is piecework on standard time, and even premium wages either correspond to a "cut-off" piecework system or have much in common with it - for instance by making use of productivity premiums with a proportional wage function line. Except in the case of "freeing of performance" linked with "freeing of piecework", the tendencies towards standardization of piecework earnings or the development of "contract wage" or "fixed wage" systems are unmistakable.

- The methods of wage determination used are for the most part highly formalized. This applies firstly to the determination of basic wages by analytical job evaluation and secondly to the determination of standard times. Even where (owing to the absence of a plant agreement) systems involving predetermined times cannot be officially used for determining standard times, these systems are of great importance (for example, in connection with schedules of guide values used within the individual plant) for

advance calculation; the final values arrived at by means of REFA time recordings exhibit only slight deviations from the times calculated in advance.

At the same time, however, the individual analyses make it clear that these general findings and their importance for company policy as regard wages in relation to performance have to be interpreted in very different ways against the background of the differing overall conditions and structural characteristics of the individual plants.

b. Production techniques, work organization and problems of company policy on performance

It should be noted in the first place that the aims as regards performance that are pursued in the individual plants in connection with the various wage payment principles and methods themselves vary with the specific external requirements (especially flexibility requirements imposed by the market), the position of the plants within the production structure of the whole company at group level and the state of production technology. Specifically: at Plant A (Type I) the changes in work organization (in connection with the freeing of piecework) are primarily designed to mobilize the workers' performance reserves and at the same time to keep the performance that is obtained flexible in response to varying external requirements. At Plant B (Type II) on the other hand, the technical and organizational structures both on the partly automated lines and in the fully automated production processes of parts manufacture and the assembly of sub-assemblies (Type IV) are designed for the achievement of steady output - the desire for the steadiest possible average performance goes hand in hand with the high degree of standardization

of product series, which is dependent in turn on a stable market situation.

Plant C (Type III) occupies a midway position from this point of view: despite the advanced degree of automation of production processes in component manufacture and surface treatment, there are rigorous requirements for flexibility owing to the plant's "supplier status"; in the assembly of sub-assemblies, where there is a large proportion of manual operations, the most uniform possible level of performance is in fact aimed at with a view to creating the conditions for the necessary flexibility of labour utilization.

A striking conclusion emerges from the analysis of the performance aims of the company's policy when Type I and Type III are compared. In Type I the freeing of performance is subject to the presupposition that the effect of fluctuations in individual performance on the production result will be offset by constant changes of work station in the assembly lines; in other words, the freeing of performance is possible only on condition that an average level of performance is assured. In Type III, on the other hand, the establishment of an average level of performance, which is in fact the essential precondition of flexible labour utilization at (transfers between) the individual work stations (interchangeability), eliminates the possibility of mobilizing individual performance reserves from the outset. There is a fundamental conflict here in company policy on performance, between the mobilization of individual performance reserves on the one hand and the assurance of a constant average performance on the other.

A comparison between Type II and Type IV is, however, also of interest from the point of view of these aspects of policy on performance. In both cases the possibility of direct influencing of the production result by increases in individual performance is excluded; in so far as performance reserves can still be mobilized, the factor of primary importance is the safeguarding of production processes (there being a high proportion of technically independent process times). Whereas in Type II constant average performance is enforced by the technical organization of production itself because of direct and indirect linking of the work tempo, in Type IV no role at all is played in the company's performance policy by any output-related average performance. Rather, there is in this case the problem of what instruments can be used to encourage the qualitative elements of performance that now exist because, within limits, in the execution of supervisory and fault-clearing tasks, and especially in maintenance and repair functions, performance becomes "free" again.

c. Production techniques, work organization and problems of company wage policy

These problems of company policy as regards performance are also reflected in the nature of the company's wage payment schemes. At first sight the different embodiments and applications of wage payment principles appear to be plausible and to some extent also "functional" when measured against the aims of performance policy reflected in the types studied. In Type I the aim of mobilizing individual performance reserves is served by the "free" individual piecework system; in Type II a "cut-off" piecework system in the form of a premium wage appears to be adequate; in Type III use

has been made of a "frozen" piecework system as an instrument for ensuring a uniform performance level; in Type IV the tendencies towards a fixed wage discernible in the various embodiments of the wage payment principles reflects the limited proportion of influenceable times in the production process.

However, as was brought out in detail in the case analyses, in the individual types the form and application of the wage payment principles give rise to a number of problems concerning the effect of the wage incentive and hence the relation between pay and performance. Thus a striking point in Type I with the combination of freeing of performance and "free" individual piecework is that, although (at least formally) no limits are set on "upward" increases in performance, a drop in performance below a plant performance norm regarded as the "average" does have consequences for the workers concerned (usually transfers to other work stations or departments). In Type III the wage incentive under a "frozen" piecework system now merely serves to prevent individual performance from dropping below the average performance level. Thus in both types PBR is acquiring a new function: it is increasingly operating also as an instrument of personnel utilization and personnel selection. At the same time, however, in Type I the mobilization of performance reserves and the establishment of a high degree of "performance transparency" is coming into conflict not only with the management's interest in steady average performance and the most reliable possible planning figures for completing production programmes, but also with the wage policy aim of keeping actual earnings under PBR schemes under control. Improved performance transparency must not be achieved at the expense of wage transparency in production planning. As has been

explained in detail, the management is endeavouring to resolve this conflict in Plant A by the introduction of systems involving predetermined times: while free individual piecework still allows fluctuations in performance, the determination of standard times by the MTM method has a standardizing effect on the development of performance indices and thus on average performance (although with a higher overall performance level).

In Type III, on the other hand, the informal limitation of piecework earnings also "freezes" performance; owing to the narrow range of fluctuation of performance indices there is a high degree of wage transparency, and reliable planning figures are available (especially at middle management level) for the completion of production programmes. At the same time, however, possible performance reserves remain concealed and "performance transparency" now exists only in the lower part of the spread of the expected average performance.

In Types II and IV these problems assume a fundamentally different form. In the partly automated assembly lines dealt with in Type II the steadiness of average performance is more or less imposed by technical and organizational factors; owing to the existence of both a direct and an indirect linking of work tempos, a drop in individual performance disrupts the assembly process and as a rule leads to appropriate action by supervisory staff (transfers between work stations, etc); consequently, the wage incentive effect exerted by "cut-off" piecework (or "premium wage") now scarcely has any effect on average performance, its only remaining influence being on the remedying of faults on the automatic assembly machines and the avoidance of imbalances (in

the provision of materials, for instance) liable to lead to stoppages and hence production losses.

The disappearance of the traditional wage incentive is even clearer in the automated assembly and manufacturing processes covered by Type IV. Here, in so far as elements of PBR still mean anything at all, they can no longer relate to a quantitatively determinable performance result but only to qualitative aspects of work performance and the performance behaviour of workers (for instance attentiveness, quickness of reaction in the event of faults, reliability).

Whereas the limited proportion of influenceable times (and also the declining labour costs per unit of output) make problems of wage transparency become almost meaningless in the case of automated assembly and manufacturing processes, problems of performance transparency present themselves precisely here with particular urgency, but in a changed form. It is no longer a question of assessing the "performance ability" of workers on the basis of the quantitative performance result they produce (or of bringing to light performance and rationalization reserves), but solely one of assessing qualitative performance elements and the performance behaviour of workers. In all the individual cases studied it was found that traditional PBR principles fail here even when they actually operate as fixed wages in the form of a "cut-off" or "frozen" piecework system or an output premium. However, known alternatives - such as quality premiums and premiums for machine use - have also proved non-operable in the field covered by the inquiry, since (apart from problems of data collection) they

give rise to serious allocation problems (this applies in particular to quality premiums, because product quality in the production processes studied is coming increasingly to depend on the material and the technical processes). Clearly, in the case of such jobs, a flat rate with performance bonuses is still the wage payment system most in line with the aims of performance policy. But it is a striking fact that this type of wage payment system is applied only to skilled workers (mechanics and electronics technicians) or workers ranked in the same category, but not to semi-skilled workers performing supervisory and fault-remedying functions in automated processes. Obviously the management considers that only specialized professional training can ensure that workers will produce the required performance even in the absence of a wage incentive (albeit now really only maintained as more or less a formality), with its "psychological" - or perhaps it would be more correct to say, ideological - effect.

d. The company-specific nature of company wage payment systems and the problems of changing them

The strategic importance of this shaping of wage systems for the attainment of aims regarding performance in the work process must not be allowed to obscure the fact that wage payment systems in companies are shaped to a very large extent both by the structures of and developments in the company as a whole and by management philosophies, so that they not only have a "process-specific" character but are also "company-specific" in nature. This is particularly the case with regard to the differentiation of basic wages in so far as this differs (as when analytical job evaluation is employed) from the collectively agreed wage category system, and also with

regard to the wage structure if this contains elements (for instance, a standard piecework rate) going beyond what is laid down under the collective agreements.

But it is in fact precisely the company-specific nature of wage payment systems that often constitutes an obstacle to any fundamental change in wage payment principles and methods for particular defined job categories in individual stages of production; there is the danger that such changes will have repercussions on the wage payment system as a whole and on the stability of the wage structure and will lead to problems regarding the fairness of wages or to open wage disputes. Such problems are mainly encountered at Plants B and C in connection with adjusting the wage payment principles that have been introduced to the changed performance requirements in automated assembly and manufacturing processes; in contrast, changes in work organization and the introduction of a free individual piecework scheme at Plant A form a coherent whole from the point of view of the company's policy regarding performance - the precise purpose of this combination is to "break up" the existing wage payment system (standardized piecework), release performance potential and enhance performance transparency.

At Plants B and C the introduction of an alternative wage payment system is impeded, on the one hand, by the uniform wage structure under the PBR system, which contains a more or less frozen, result-related wage component plus, at Plant C, supplements eligible for incorporation in collective agreements and also ones not thus eligible (partly for reasons of attractiveness in the labour market but partly also as the "price" for the introduction of analytical job evaluation); outright abandonment of PBR would lead to losses in earnings for

the workers in automated manufacturing and assembly processes and give rise to burning issues concerning the fairness of wages. On the other hand, analytical job evaluation constitutes an obstacle to corresponding wage compensations in the fixing of basic wages; a special system of supplements for "automation workers" would have the effect of detracting again from the transparency of basic wage differentiation achieved through analytical job evaluation.

From these problems it can be seen that uniform wage payment systems which are based on formalized wage determination methods and are designed to fit in with a pronounced standardization of production and a highly developed level of production technology tend, in fact, towards rigidity, despite the possibilities of differentiation which they offer.

2. Problems and effects in the opinion of the workers concerned

In the foregoing case analyses reference has been made in several places to the special performance requirements and stresses which the described changes in work organization and technical organization entail for the workers concerned; for this aspect we have relied on the statements made by the experts questioned, especially members of the lower management and members of the works council. Very briefly, the following picture emerged:

- The changes in work organization in the sphere of manual assembly tasks do not result in the elimination of repetitive sub-operations; the interchangeability between the "decoupled" production-line work stations and the need to transfer workers bet-

ween the various traditional work stations create increasing requirements for concentration and additional stresses caused by familiarization difficulties.

- Where assembly processes are partly automated, the restrictive" aspects of repetitive sub-operations are aggravated by direct and indirect linking of work tempos and extremely short cycle times.

- Lastly, in supervisory jobs in automated manufacturing and assembly processes the work also in some cases imposes high demands for concentration and also involves physical stresses due to an uncomfortable working posture (standing).

In contrast, the opinion of the company experts concerning the effect of the various wage payment principles and methods on the work situation of the workers concerned is lacking in unanimity and ambivalent. For instance, the experts consider PBR to be absolutely indispensable; they are also in favour (subject to the appropriate conditions as regards work organization) of a "free" piecework system, but at the same time some of them feel that there is a danger that workers may overexert themselves in order to push up their earnings. While the experts consider that the principles of wage payment need to be reviewed for application to automated work, they still adhere to the principle of PBR. They welcome a differentiation of basic wages that is "consistent with job requirements" (on the basis, for instance, of analytical job evaluation), but at the same time see a danger of environmental and physical stresses being viewed in monetary terms as a result of this.

Precisely because of this it seems necessary to present, in addition to the experts' judgement, the workers' own assessment of their work situation.

It was not in fact possible within the framework of this study to carry out more detailed separate surveys (interviews, systematic job analyses, etc) concerning the effects on the workers themselves of the various wage payment forms and methods and forms of work organization and production techniques. Instead of this a secondary evaluation was made of a survey conducted among workers by the Institute for Sociological Research (Institut für Sozialwissenschaftliche Forschung) concerning their experience of the work situation with traditional production-line working and with new forms of work organization. This survey included workers in the industry studied by us (Plant A and another plant in Germany). The results are based on individual oral interview and group discussions with about 500 industrial workers. The survey was conducted during the period 1976-78 in nine plants in the metal-using and electrical engineering industries (cf Altmann et al 1980, Vol III). In the section which follows the results which are of relevance to the questions studied by us are presented not separately for the forms of combination of production technology, work organization and wage payment which we have been discussing, but rather on a problem-oriented basis.

a. Effects and assessments of wage payment forms and methods

(1) General assessment of the interrelation between wages and performance.

Contrary to the management's opinion (which is also the preponderant opinion in our study) that workers

(especially in jobs requiring little skill) are solely interested in obtaining the highest possible earnings, the results of the interviews reveal that the workers' interest in obtaining the highest possible earnings is not the only matter of concern to them but that they attach importance to the interrelation between earnings and the conditions under which they do their work. In this connection, furthermore, there are no differences of any importance between the views of German and migrant workers.

(2) "Fixed wage" versus free individual piecework.
"Fixed wages", such as the frozen piecework system, are assessed ambivalently by workers: they see as a positive aspect the "wage guarantee" ("greater security") which this system offers together with the fact that shortcomings and changes in work organization do not jeopardize the level of incomes. On the other hand, fixed wages are assessed critically in cases where there is a large proportion of influenceable times (especially in the case of longer work cycles) and where the workers would be (or are) able to exceed the "performance norms" (eg the stipulated performance index) laid down and demanded by the company; likewise in cases where the "fixed wage" results in closer supervision and disciplinary action on the part of the workers' more immediate superiors with the object of ensuring a steady level of performance. It is also apparent that with systems of "fixed wages" the workers' sensitivity with regard to dissimilar working conditions and different requirements and stresses in individual jobs increases. An important point here is that the criticism against fixed wages is levelled not against this wage payment system in itself but against the interrelation between wage payment system and work organization or working conditions.

But their critical assessment of fixed wages does not mean that the workers prefer the "free" piecework system or regard it more favourably. This is clear from their assessment of the effects of the change-over from the "frozen" piecework system to the "free" individual piecework system at Plant A (Type A). The majority of the workers questioned in this plant (82%) complained of a deterioration in the plant's working atmosphere as a result of growing internal tensions, the pressure of competition and also ill-will and envy among workers. The main reasons for this were said to be varying requirements in the number of units to be produced, depending on the judgement of the workers' superiors, mutual "hustling over piecework" and the wider spread of earnings categories. The atmosphere on the traditional conveyor belts with a frozen piece-work system was considered to be definitely better. There is also criticism of the danger - and actual occurrence already - of physical and psychological overstrain due to a higher work-pace (82%). An in-creased psychological stress for the workers is also produced, in particular, by the fear that the standard times may be reduced as a result of peak performances by a few workers. This fear of "rate cutting" is re-garded by workers in this field as one of the most serious disadvantages of individual piecework.

Another interesting point in this context is the fact that the majority of the workers questioned (two thirds) reject the idea of a "group bonus" in connection with the introduction of new work organizations. About half the workers rejected group payment systems for tradi-tional forms of production-line working. The main adverse feature here is felt to be the restricted pos-sibilities of variation in individual performance; the workers are constantly obliged to subordinate their

own way of working to the tempo of the conveyor belt or the group. The workers expect individual working and individual piecework or individual premiums to give them a much fairer remuneration for their work because under a group piecework system certain kinds of individual or collective performance have no effect - or even an adverse effect - on earnings.

(3) Assessment of standard times. Altogether about 60% of the workers questioned regarded either all the standard times or those for certain processes as "very tight", while only about 40% felt that the standard times suited them "well".

Criticism was levelled against the standard times particularly with regard to working processes involving frequent changes of work (a large variety of product types and variants, fluctuations in the number of units, transfers between work stations and to other departments) and in the case of processes requiring both a high work-pace and high product quality at the same time. The standard times were regarded favourably, on the other hand, in the case of working processes entailing no (or only a minor) change in product types and variants, and also in processes where, as a result of selection within the plant, mainly experienced and more efficient workers were used.

With regard to the assessment of standard times it should be borne in mind that the workers generally have little knowledge of the wage-determining methods involved in working out standard times, so that these are also largely outside the scope of their assessment or criticism. (Generally there is very little wage transparency for the workers questioned; two thirds of them were only able to give a very rough

idea, or none at all, of the structure of their wages.) On the other hand, the workers have a very accurate knowledge of the effects produced by the fixed standard times and the changes in them on the execution of work, the work-pace and earning possibilities. In this respect the actual application of the various methods of determining standard times also gives rise to considerable differences in the opinions of workers.

For instance, the presence of the "timekeeper" or the activity of "time recording" at the work station in accordance with the REFA method is regarded as trying by many workers. The presence of the company's experts creates for the workers a stress situation of increased strain to the extent of causing nervousness and mistakes in working - a factor which chiefly becomes operative when there are frequent changes in work organization; secondly, workers feel that they are being particularly watched and feel compelled to make special efforts or achieve a special performance; this also distorts the basic conditions for the fixing of standard times. With the MTM system this stress on the workers disappears. It is replaced, however, by a new stress, namely the "uncertainty" about the fixing of standard times by the management, and especially changes in these times. Thus the REFA method has at least one advantage in that the workers can directly witness the time determination and accordingly also the changing of standard times. Under the MTM system, on the other hand, efforts by the management to re-estimate and change standard times cannot be directly observed by the workers. Consequently, the already existing fear of changes in standard times in connection with minor changes in work organization is increased. On top of this there is the fact that in the REFA method it has become standard practice that only relatively major changes in the working process and work

organization justify a revision of standard times. In the MTM method, however, even very slight changes in the working process affect the standard time.

(4) Assessment of basic wages. Owing to the low degree of transparency of wage payments from the workers' point of view, it was not to be expected that they would be able to express any opinion on the different methods employed for the differentiation of basic wages: consequently the workers were not asked to give any overall judgement concerning the methods employed for differentiating basic wages (wage category system under collective agreements, analytical job evaluation). But the assessment of possible criteria which, in the opinion of the workers questioned, ought to be taken into account in the differentiation of basic wages revealed a striking fact: the categories employed in analytical job evaluation for evaluating jobs (mental requirements, physical requirements, responsibility, working conditions or stresses) largely coincide with those considered to be of importance by the workers. Other criteria for wage classification such as the age of the workers, their seniority in the company, family status, etc, on the other hand, are not felt by the workers to be necessary for differentiation in wage classification. On the whole it is mainly unskilled and semi-skilled workers who consider it a good thing that the classification is determined exclusively by job requirements and not by person-related criteria such as training.

Criticism is, however, levelled against the content and differentiation of the individual criteria in company wage systems. Particularly in connection with the responsibility criterion the workers complain that this concept is viewed in much too narrow a sense. In the

workers' opinion no account is taken of responsibility for product quality, social behaviour, or the workers' responsibility for their fellows (training and familiarization of new colleagues, spontaneous help at other work stations, etc). The workers also consider that not enough account is taken of responsibility for safety at work (especially when there are more frequent transfers between work stations) and of work stresses resulting from the high work-pace, an imposed physical posture and the like.

b. Work organization and production techniques

It should be pointed out in advance that in this section we are dealing only with a few aspects which are of particular importance in the workers' opinion. In actual fact both the effects of the forms of work organization and production structure described and also the way in which they are perceived and assessed by the workers are much more complex and multi-layered.

(1) Decoupled individual work stations

In contrast to conventional production-line working, the workers have a favourable opinion of the possibilities of greater freedom in the use of time and for individual variation in performance in the course of a working day. On the other hand, they particularly criticize the fact that, in so far as the standard times and individual efficiency make it possible to achieve above-average performance, this can only be attained if changes of work station are accepted. There is also felt to be a greater danger of physical and mental overstrain, etc, at individual work stations in combination with individual PBR.

(2) Flexible utilization of labour. All the workers have an adverse opinion of transfers between work stations and frequent changes of job. The main grounds for this negative assessment, in the workers' own opinion, are the fact that it becomes necessary again to learn a new task (familiarization with simple work operations), resulting in the danger of losses in earnings. Transfers between work stations and to other departments are favourably viewed by workers only when earnings are in principle safeguarded; under these conditions the workers could possibly benefit by - and hence take a favourable view of - the opportunity of reducing monotony and unbalanced stresses offered by more varied work.

(3) Ergonomic design of working conditions. As stated, the plants concerned often present the design of workplaces according to MTM principles as the design of working conditions based on "established work-science findings" and thus as a contribution to improving working conditions. The workers, however, take an ambivalent and sometimes very critical view of the effects of workplaces designed according to MTM principles. An important criticism is that there are no supporting measures of work organization such as would enable the workers to benefit by any positive effects of the working conditions determined according to MTM. A fundamental problem is the fact that the high level of requirements as regards performance cancels out any positive effects resulting from the work being easier, and also creates new stresses. To give an example, taking advantage of the possibility of performing tasks either sitting or standing results in losses in performance and therefore is not or cannot be done by the workers. Furthermore, for instance, back supports on chairs cannot be used because the nature of the job usually

requires the worker to sit bent forward. In some cases, furthermore, the working processes designed according to MTM principles are themselves regarded as very trying - for instance the synchronization of "bi-manual" movements and working operations.

(4) Mechanization and automation. In the workers' opinion a particularly adverse feature in the case of highly mechanized and partly automated machines and production systems is the high degree of subordination and chronological linking of the working process to the machine tempo and to process operations - as is the case, for instance, in partly automated assembly lines and the like. Here the stresses are also unanimously considered by the workers to be greater than in the case of predominantly manual activities.

3. Problems and effects for industrial relations in the plant

As was outlined at the beginning (Chapter I), the system of industrial relations in the Federal Republic of Germany assigns to the works councils mandatory rights of co-determination in connection with the introduction or changing of wage payment principles and methods (Article 87, paragraph 1, subparagraph 10 of the Law on the Constitution of Businesses) and with regard to the determination of all reference quantities for the calculation of PBR (Article 87, paragraph 1, subparagraph 11 of the Law on the Constitution of Businesses); in addition the works council has rights with regard to information and a corrective right of co-determination with regard to the introduction of new production techniques and new forms of work organization (Articles 90 and 91 of the Law on the Constitution of Businesses). In the case analyses

it became clear that the works councils were as a rule consulted in connection with the plant changes in question. But their influence on the development of production techniques and also on changes in work organization must be considered slight. On the other hand, the actual scope for negotiation by the works council in connection with the introduction of new wage payment principles and methods on the one hand and the determination of reference quantities for PBR on the other calls for varying assessments. For instance, the works council was able to gain acceptance of demands of its own upon the introduction of the MTM system for the fixing of predetermined times at Plant A and also in connection with the introduction of analytical job evaluation at Plant C, with the support of the trade union. With regard to the determination of the reference quantities for PBR - and especially in connection with the determination of standard times - the works councils' scope for negotiation is, however, limited precisely by the use of highly formalized methods (and the same applies to the actual influence of the works councils on job evaluation in the joint evaluation committees). Although, or actually because, the works councils are permanently involved in the process of plant wage determination through the setting up of joint committees (piecework committee, evaluation committee) there is a danger that the relation between wages and performance will be formalized (and thus also made untouchable) as a <u>field of negotiation</u> for plant bargaining between the two interest groups and that the works council members themselves will be pushed aside into the role of plant experts. The findings of our survey in the above-mentioned inquiry (see Altmann et al 1980, Vol II) indicate that <u>generally</u> the relationship of the work-force to the works council is primarily characterized by the following three problems,

which possibly tend to be intensified rather than reduced by the developments described:

(1) The fact that the works council's activities are not sufficiently concerned with the direct problems at the workplace. On the question of the organization of the work process (concrete utilization of labour, co-operation problems, performance requirements, etc), it is only in exceptional cases that the workers regard the works council as a partner to whom they can address themselves.

(2) Insufficient contact between the works council and the workers, especially the "remoteness" of the works council;
and, lastly

(3) inadequacy of the information given to the workers about the works council's activities and, accordingly, insufficient involvement of the workers in those activities.

Independently of the actual activities of the works council and their effects, these survey findings indicate that, at least in the workers' opinion, clearly important matters of crucial interest to the workers are not taken up and pursued by the works council, or only to a very limited extent. For instance, only 28% of the workers were of the opinion that the works council acts positively in the workers' interests; on the other hand, 37% took the view that the works council's activities would have a positive effect for the company (while for 35% the effect of the works council's actions was unfathomable).

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